News and Views

in the Biological Sciences

THE AIBS BULLETIN

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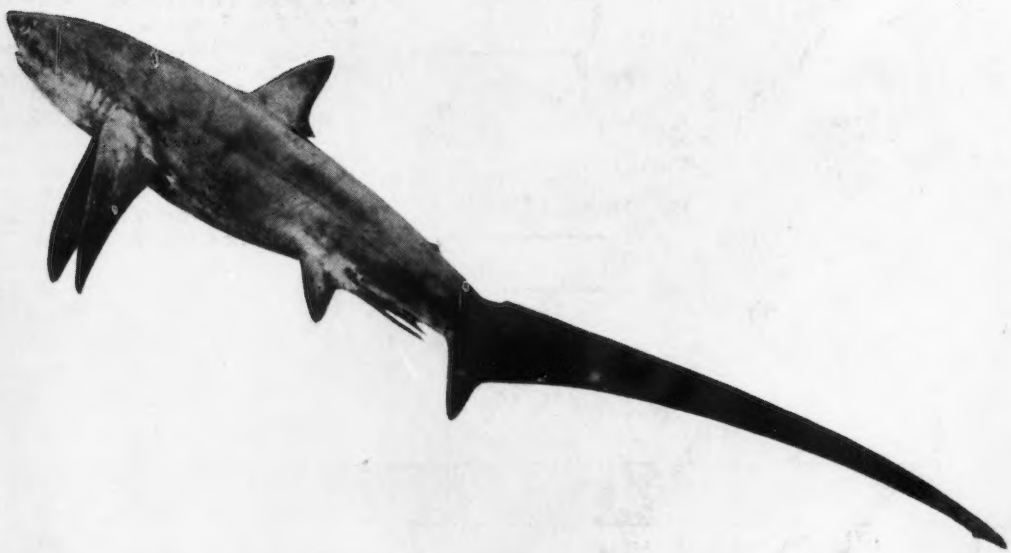

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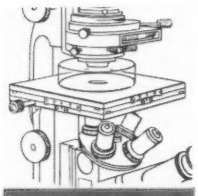

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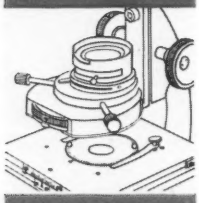

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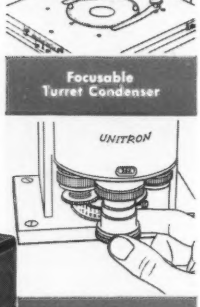

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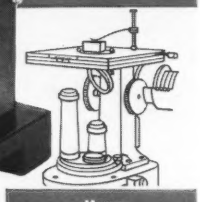

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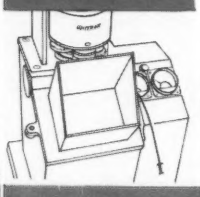

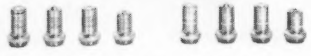

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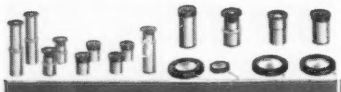

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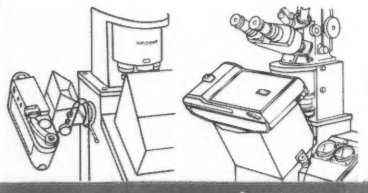

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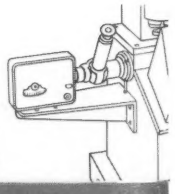

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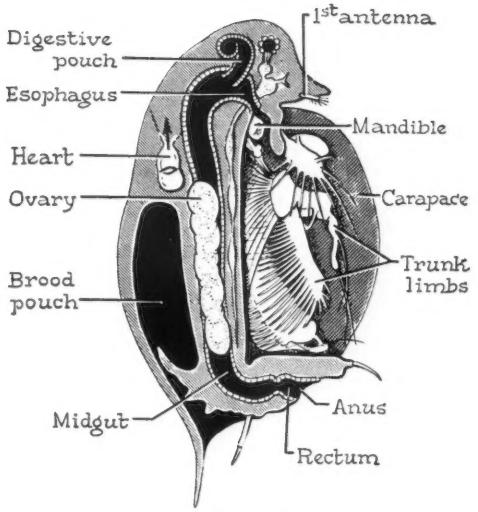
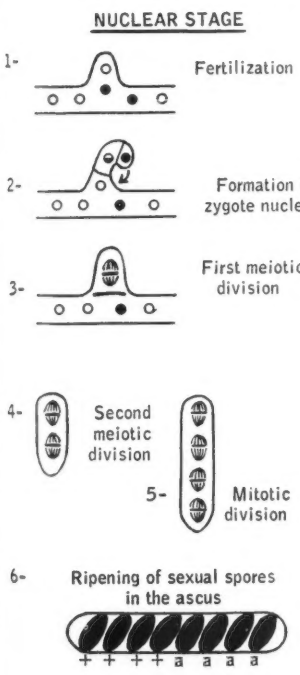


Water flea.

Strauss— An Outline of Chemical Genetics



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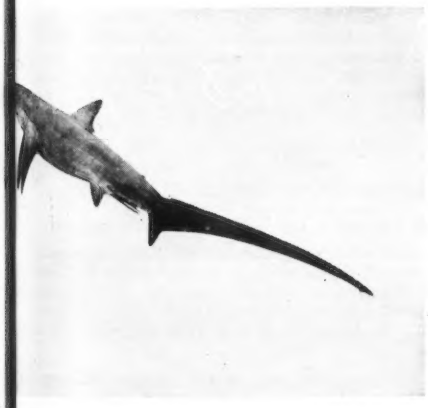

Cover Picture: Photograph of a cast of a large bigeye thrasher shark on exhibit in the Smithsonian Institution, Washington, D.C. The original shark was caught by Michael Lerner of Connecticut in New Zealand waters.

The BSCS: A Challenge to the Colleges *17*
ARNOLD B. GROBMAN
New high school courses create opportunities for college biology teaching

Support of Research by NSF *21*
JOHN T. WILSON
Aid is given to basic biological and medical research activities

Radiation Research at a Tropical Center *25*
HOWARD BOROUGHS
Nuclear energy is used in Latin-American agricultural studies

Inland Education of Oceanographers *27*
LOUIS S. KORNICKER
A strong faculty versus university location in the production of oceanographers

Letters *5*

The Editor's Desk *29*

AIBS Reports *32*

Library *33*

List of Societies' Local Representatives for the 1962 AIBS Annual Meetings *48*

Index to Advertisers *48*

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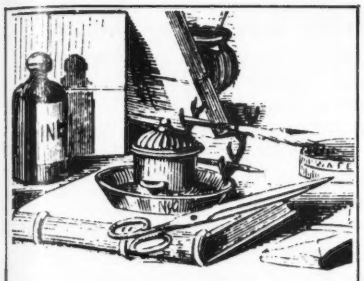

LETTERS

The U.S.S.R. was establishing its supremacy in the world by means of the Absolute Weapon (see the *AIBS Bulletin* for June 1961), when an unknown professor in the biological sciences in one of the Junior Colleges of America remembered having read an article which one of his students had handed to him. If his memory was correct, the article had been published in that outstanding compendium of science and literature, *Esquire*.

The suggestion which was presented in the article was to keep a human tissue culture bank of undifferentiated cells from all of the great people of the world, mentioning particularly Winston Churchill. Then if a technique could be developed to cause these cells to differentiate in a normal manner, any number of Winston Churchills could be produced as desired.

This then unknown biologist demonstrated by experimentation with tissue cultures of animals that such undifferentiated cells could be implanted in the uterus made receptive by administration of progesterone and that such cells would then produce a normal foetus. This technique was successfully applied to human beings. Since the great minds of the world had sought asylum from communist tyranny in the free world, it now became possible to multiply these individuals without having to do any controlled human breeding. Women of lesser mentality were delighted at the opportunity to bear gifted children and the Eugenics Council had no difficulty in obtaining volunteers.

In one generation, the free world reestablished its leadership, intellectually as well as economically; demonstrating the superiority of the American system of free enterprise and equality of education whereby an unknown professor of biology in a Junior College provided the defense against the Absolute Weapon.

Edwin D. Woodhouse,
Life Sciences Department,
Los Angeles City College

Let me congratulate you upon the publication of McConnell's paper, The Absolute Weapon, (*AIBS Bulletin*, II: 14-16). It was most disturbing and thought-provoking. It deserves wide circulation, not only among biologists, but among western legislators and educated people generally.

The purpose of this letter is to urge that our competitive position, while difficult, is not hopeless. McConnell defines the absolute weapon as one which the enemy cannot or will not use in retaliation. That the G Program which he (fictionally) ascribes to the Russians might actually be carried out by them is undeniable. We can only hope that Lysenkoist control would reduce its efficiency.

That we of the West could not duplicate that program for cultural and moral reasons is also clear. Nonetheless, other G programs may be possible without violence to our principles. One of my colleagues suggested that progress might be made by so simple a device as increasing the social program in our faculties of science, so that science students would tend to make their friends and marry primarily among themselves. A similar result has been obtained in some countries by intensification of the professional curricula. For example, the Hungarian refugees of 1956–1957 included many husband and wife teams. This was a result of profession curricula so heavy that students had little opportunity to meet potential marriage partners except among their classmates. There is currently much interest in intensification of the curriculum (see Rickover, H.G. 1959. Education and freedom. Dutton), and some eugenic contribution from this quarter is possible.

Many programs of positive eugenics have been proposed in the West, but they have required heavy government financing. This makes them especially difficult to establish in a free society. But no program could be so costly as final defeat by the communist prophets of regimentation. McConnell ascribes the success of the hypothetical Russian program in part to its limited scope. If marriage subsidies were offered to the top one (or few) per cent of our university classes, conditional upon both partners being from this group, the result might be strongly eugenic. Such subsidies would have to be adequate to permit child bearing without interfering with completion of professional training.

While this program would be based upon free choice, it would require public financing, and so would be opposed by many people who are unable to see their long range welfare when immediate taxation is involved. Nonetheless, there are precedents in the free world. Canada has for many years paid family allowances on the basis of children under 16. The Province of Quebec now extends this to 18 *if the children are still in school.* The public has applauded this change, although a very large proportion of Quebec children do not complete the high school course. Ontario now proposes to underwrite the cost of university education for all A students. While this has not yet gone beyond the stage of a small pilot experiment, it has attracted widespread support, and it is generally accepted in Canada that it is only a matter of time—and not too much time—until university education will be publicly financed for all students who demonstrate outstanding ability. From such measures as these to marriage subsidies for *very* superior students is not too long a step.

Dr. McConnell makes a very strong case for the probable success of the hypothetical Russian program, and it is not clear that the one here suggested could not be as effective in the West. I have proposed this program not only for the faculties of science but for the universities as a whole. Thus its product should be not merely a scientific élite, but an élite in all phases of culture. This takes cognizance of the concern of many western leaders lest we let the Russians frighten us into neglecting nonscientific disciplines. And it may be just this aspect of our project G which will ultimately assure the victory of the free world.

May I suggest that the AIBS establish a committee to investigate the feasibility of such a program and to work out its details; that it invite its sister societies in other free countries to carry out similar studies; and that the AIBS and its sister societies work actively for the enactment of legislation to implement the reports of these committees for project G?

Edward O. Dodson
Department of Biology
University of Ottawa

We goofed! In the caption for the cover of the October *Bulletin* we neglected to mention the radiolarian which appeared in the upper right-hand corner. This was purely an oversight—not an intentional slight!

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by HERBERT H. ROSS, Illinois Natural History Survey

From cosmic dust to biomes, this important new book describes the dynamic processes and principles which have led to the evolution of the living world. Synthesizing material from many disciplines, Dr. Ross achieves a fresh objective view of the evolutionary relationships between the living and non-living worlds, demonstrating the inexorability of the various evolutionary processes. Here, evolution is viewed as the unifying principle of the universe, with special attention given natural selection and the vital role played by the dynamics of the earth's crust. Written in language readily understood by the interested student or naturalist, the text incorporates many new theories and findings previously available only in research journals. It offers new perspectives and approaches for investigation in many fields.

February, 1962 *Approx. 416 pp.* *Text price: $7.50*

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by NEAL D. BUFFALOE, Arkansas State Teachers Col.

A brief, selective presentation of the fundamental principles of biology organized around the concepts of metabolism, growth, reproduction, responsiveness and adaptation. The book is strongly oriented toward the relation of biology to other fields of human endeavor, and is thus philosophical in its overall viewpoint. In the Prentice-Hall Biology Series, Edited by William McElroy and Carl Swanson.

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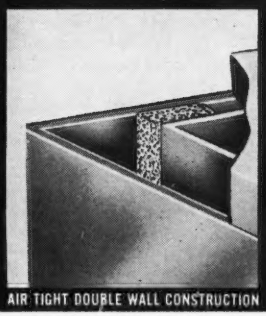

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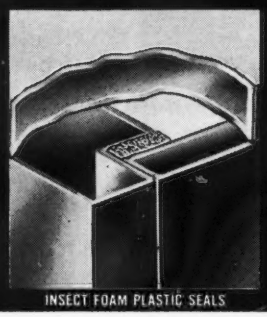

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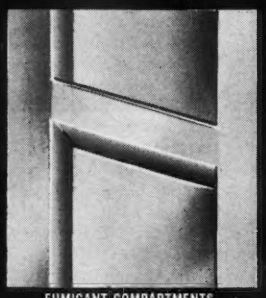

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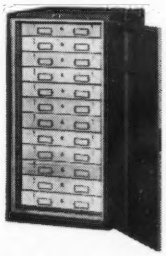

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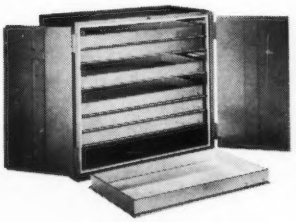

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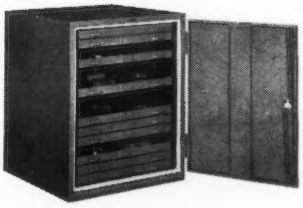

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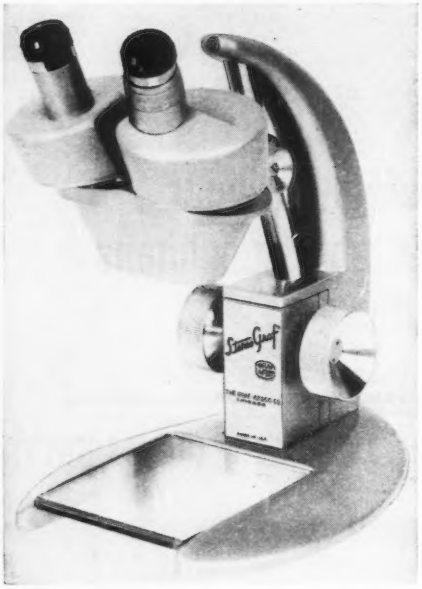

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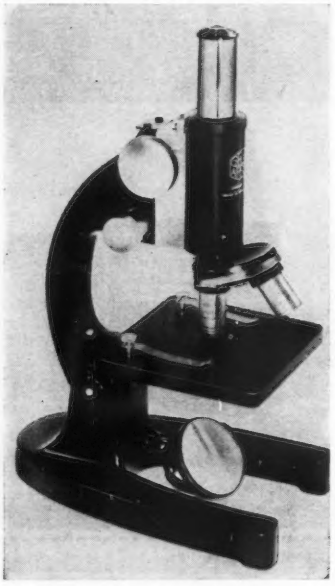

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Edited by VICTOR A. McKUSICK, M.D., Professor of Medicine, Johns Hopkins Hospital, Baltimore, Maryland. Written by 48 contributors. Published December, 1961. 534 pages, 6⅞" x 10". Price, $14.50.

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HUMAN PHYSIOLOGY, *Second Edition*

By W. B. Youmans, University of Wisconsin

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A LABORATORY SURVEY OF BIOLOGY

By Lawrence S. Dillon, Agricultural and Mechanical College of Texas, and William A. Cooper, West Texas State College

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THE FUNDAMENTALS OF COMPARATIVE EMBRYOLOGY OF THE VERTEBRATES, *Revised Edition*

By Alfred F. Huettner, late of Queens College (New York)

1949, 309 pages, ill., $6.25

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1953, 115 pages, paper, $2.75

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By Oscar E. Tauber, Robert E. Haupt and Delma E. Harding, all of the Iowa State University of Science and Technology

1960, 190 pages, ill., paper, $3.50

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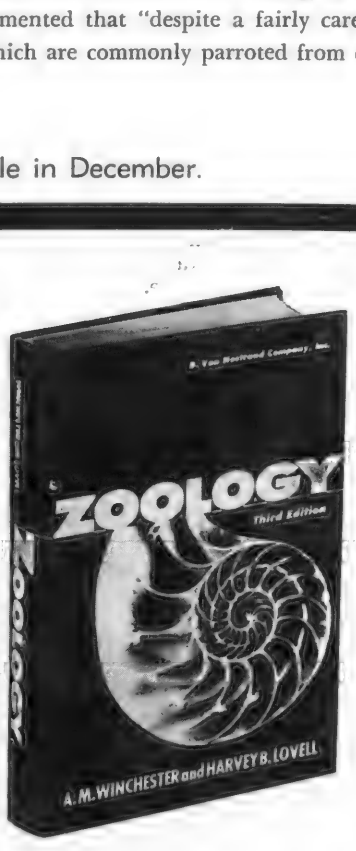

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THE AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES has been interested in biological education since the very early days of the Institute and one of its first standing committees was the Education Committee. In 1959, this committee established the Biological Sciences Curriculum Study (BSCS) "to seek the improvement of biology education." The AIBS was fortunate in obtaining as BSCS Chairman, Dr. Bentley Glass of Johns Hopkins University, a former AIBS President. BSCS offices were established on the University of Colorado campus and its programs have been financed primarily through grants from the National Science Foundation, totaling over $2 million to date. Major policy is set by a Steering Committee which consists of 27 members—outstanding research biologists, high school teachers, educators and others interested in biological education. The BSCS operates with a small headquarters staff in Boulder, and to a major extent depends on working committees and consultants to carry out its tasks. Over 1200 biologists, including many readers of the *AIBS Bulletin*, have contributed to its work.

The first major focus of the BSCS has been on high school biology and on the preparation of general biology courses for the typical tenth grade student. The situation in high school biology is quite different from that in high school chemistry and physics. In America, today, eight out of every ten high school sophomores take biology; these students run the gamut in intelligence, aptitude and interest. Only three in ten high school students take chemistry and two in ten take physics—and these are generally the college preparatory students at the higher ability levels. Thus, tenth grade biology has a broad range of students where high school chemistry and physics have relatively homogeneous groups of students. Furthermore, of the students taking tenth grade biology, about half never again take another science course—they take no more high school science and they do not go on to college. Tenth grade biology is their last formal contact with science in the school system. This gives high school biology the added responsibility of interpreting our scientific society to these students and of preparing them for living in a civilization that will be characterized by revolutionary scientific changes throughout their lives.

In preparation for its work in designing new high school biology courses, the BSCS asked Dr. Paul Hurd of Stanford University to review biological education in American secondary schools during the last 70 years, giving particular attention to the recommendations of earlier commissions that had been established to study biological education in the secondary schools. Dr. Hurd's study has been issued as the first volume in the *BSCS Bulletin* series on biological education, and may be obtained from the AIBS.

Three Biology Courses

The decision was made by the BSCS to prepare three distinct and complete tenth grade general biology courses. In providing such an array of model programs for high schools, the BSCS is trying to indicate what competent research biologists and high school biology teachers feel are desirable programs for today's high schools and, in this way, to stimulate independent writers to design additional text and laboratory materials that will improve the general level of secondary school biology teaching.

A preliminary experimental edition of three versions of BSCS *High School Biology* was prepared during the first Summer Writing Conference held on the University of Colorado campus in the summer of 1960. Seventy research biologists and high school biology teachers, on three writing teams, produced the Blue, Green and Yellow Versions of BSCS *High School Biology*. These provide complete course materials, including texts, laboratory manuals, teachers' guides to the laboratory, and a teacher's commentary. In addition, a series of brief techniques films were prepared to familiarize teachers with various specialized laboratory procedures.

The preliminary experimental volumes were tested by 105 teachers with 14,000 students during the 1960-61 school year. Throughout the year, systematic feedback was obtained on these classroom experiences in various ways: through teacher and student reports, through

classroom visits by BSCS staff members and Steering Committee members, and through results on newly developed tests prepared in cooperation with Educational Testing Service. In addition, all versions of BSCS *High School Biology* were examined and criticized by many outstanding biologists, educators, psychologists and others, as well as by education committees of a number of professional societies including the National Association of Biology Teachers, the American Society of Plant Taxonomists, the Ecological Society of America, the American Society for Microbiology, the American Phytopathological Society, and the American Psychological Association.

Based on this criticism and feedback, a Second Summer Writing Conference during the summer of 1961 prepared revised experimental editions of BSCS *High School Biology*. These revised materials are being tested extensively during the present academic year in schools in 37 states and four foreign countries; over 500 teachers and 50,000 students are involved in various phases of the 1961-62 Evaluation Program. Plans have been made for systematic feedback on the classroom experiences and further testing of student achievements. Based on this information the materials will undergo a final revision before being made generally available.

Other Important Programs

Though preparation of these three basic courses has been the major effort of the BSCS thus far, several other important programs are also under way. The Committee on Innovations in Laboratory Instruction, under the chairmanship of Dr. Addison E. Lee of the University of Texas, is developing a new approach to the use of the high school biology laboratory. Dr. Lee's group is producing a series of laboratory blocks in such areas as: animal growth and development; plant growth and development; microbes: their growth, nutrition and interaction; interdependence of structure and function, ecology of land plants and animals; animal behavior; and plant hormones.

A single block may be used during the school year to supplement the regular BSCS *High School Biology* materials (or traditional courses). A laboratory block takes six weeks of class time and during this six-week period all student activity is concentrated on the problem area of the particular block being utilized. The students progress from simple to more sophisticated experiments, thereby gaining an experience in depth in at least this one area; a better idea of how scientists actually work in the laboratory; and an appreciation of how scientific discovery progresses.

Another facet of BSCS activity has been the work of the Gifted Student Committee under the direction of Dr. Paul Brandwein, of Harcourt, Brace and World, Inc. From biologists throughout the country the committee had requested research prospectuses of unsolved biological problems suitable for exploration by creative high school biology students. One hundred of these prospectuses have been selected and edited for a first volume of investigations for students and are currently in use. The Gifted Student Committee also has a volume in preparation designed to help teachers in their work with creative science students.

With additional assistance from the National Science Foundation and the Rockefeller Foundation, nine visitors from five foreign countries spent the past summer in Boulder working cooperatively with the BSCS in preparing adaptations of these materials for use in their own countries. During the coming year, local adaptations of BSCS *High School Biology* will be used experimentally in Argentina, Brazil, Colombia, and Thailand. Work is also under way on a Nigerian adaptation.

Nine Basic Emphases

Two important questions frequently asked about BSCS *High School Biology* are: "In what way do the new secondary school course materials differ from traditional books?" and "How do the three versions—the Blue, Yellow and Green Versions—differ from each other?" It is hoped that all three versions bridge the traditional gaps between scientists, teachers and education specialists. The skills of all three of these groups were used in a collaborative effort to produce BSCS *High School Biology*. These books represent drafts of the best thinking of teams of research biologists engaged in restructuring the content for student needs in tenth grade biology, and they also incorporate the skills of high school teachers and specialists in education.

The three revised versions of BSCS *High School Biology* have a unifying factor—a common thread—which also distinguishes them from conventional texts. This unity arises from the agreement of all writers concerned with BSCS *High School Biology* that the following nine themes—nine basic emphases—be woven in and through each version:

1) change of living things through time—evolution
2) diversity of type and unity of pattern of living things
3) genetic continuity of life
4) complementarity of organism and environment
5) the biological roots of behavior
6) complementarity of structure and function
7) regulation and homeostasis: the maintenance of life in the face of change
8) science as inquiry
9) the intellectual history of biological concepts

To give an idea of the way these unifying themes are woven through the materials let us look at the way one, science as inquiry, is handled. Five ways of teaching science as inquiry are used. *First*, there is liberal use of such forthright expressions of uncertainty or incompleteness as: "We do not know." "We have been unable to discover how this happens." "The evidence about this is contradictory." *Second*, where possible, the BSCS materials replace authoritarian statements of conclusions with accounts of the development of our knowledge. That is, current views on a subject, such as genetics, are developed step by step through a description of the experiments performed, the data obtained and the interpretations made of them. *Third*, the laboratory work is organized to convey a sense of science as inquiry. For example, the conventional illustrative type of laboratory exercise often is replaced by

investigatory exercises. Some of them treat problems for which the text does not provide answers. They introduce the student to situations in which he may participate in the inquiry. *Fourth,* the laboratory block programs engage the students in the investigation of a variety of biological problems, each of which is a meaningful introduction to scientific investigation. And *finally,* a new teaching device, invitations to inquiry, is used. An invitation may describe a problem, the experiment done to solve it, and give the data found; it then invites the student to interpret the data and derive conclusions. Or it may set the stage for the student to consider ways and means of controlling variables in an experimental design. Or it may provide a problem situation and relevant data, and then invite the student to develop hypotheses to account for the data. Or it may ask the student to devise ways for testing one or another hypothesis.

In a comparable manner, the other eight unifying themes permeate all three versions.

Another aspect of BSCS *High School Biology* that distinguishes it from conventional course materials is the stress on the laboratory as a teaching device. Laboratory work has a more important role in BSCS *High School Biology* than is the case in traditional biology courses. During the Testing Program last year, BSCS teachers spent twice as much time in the laboratory as they did during the previous year when using conventional course materials.

These features the three versions have in common—features which set them off from the usual conventional materials. However, there are also differences among the three versions. One way of examining these differences is by looking at the emphasis in each of the versions of BSCS *High School Biology* in terms of levels of biological organization. Biological organization may be considered at these seven levels: molecular, cellular, organ-tissue, individual organism, population, community, and world biome.

To make a comparison between conventional texts and each of the three BSCS versions, a qualitative estimate of the emphases in each was made by some of the writers at the Second Writing Conference. Figure 1 suggests the different emphases between a composite of representative conventional secondary school texts and the three BSCS versions. The modal interest of most current books is on the organ and tissue level; only two other levels—the cellular and the individual organism—approach even half of this emphasis. The Green Version exhibits greatest emphasis on the community and the world biome; there is also a strong development of the levels of the individual organism and the population. In the Yellow Version the major emphasis is concerned with the cellular level with low emphasis on the organ and tissue level. The Blue Version shows the greatest emphasis at the molecular and, next, the cellular level. Clearly the emphasis in each version of BSCS *High School Biology* is fundamentally different from that of today's standard high school biology books as well as different from each of the other two versions.

The consensus of the biologists who have prepared the BSCS materials, of teachers who have worked with them in the schools, and of specialists who have examined them is that these materials, in their preliminary experimental form, are in many important ways superior to the high school biology materials heretofore available. Virtually every teacher (103 out of 105) who was able to use BSCS materials for a second year did so.

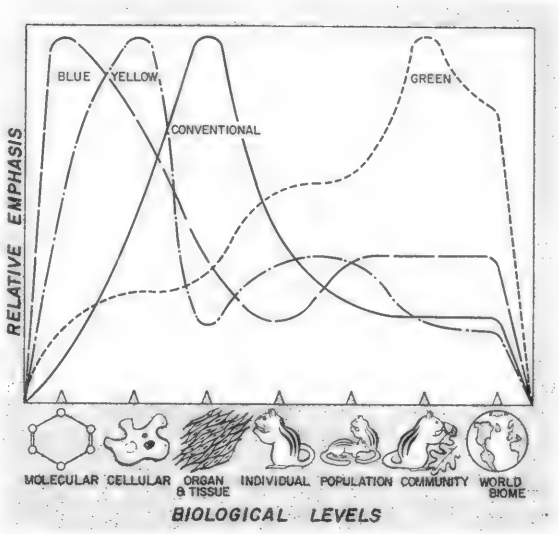

Fig. 1

Problem for Colleges

The college community has expressed interest in these new materials in connection with problems of teacher preparation. During the past summer, directors of 26 NSF summer institutes elected to emphasize BSCS *High School Biology* in their institute work. During the coming year, several universities will offer teacher in-service institutes and workshops in BSCS *High School Biology.* Several academic year institutes will use these materials. And additional directors of summer institutes have already indicated their interest in focusing on BSCS *High School Biology* next summer.

A difficult problem is now arising for the colleges. Consider these three propositions, the first two of which could now be easily demonstrated:

1) The new BSCS high school biology courses are as sophisticated, and more significant, than a great many current introductory collegiate courses.

2) More than three-quarters of high school sophomores are able to master BSCS biology.

3) Student retention of BSCS biology, from the sophomore year of high school to the freshman year of college, is not significantly less than for other biology courses. (Because the Curriculum Study is so young, no information on retention of these new materials is yet available; however retention studies are planned.)

The implications for the colleges are clear. Campuses will soon have as freshmen, first, a small number of students who have not studied biology in high school as well as a far larger number who have. Among the latter will be, second, some who have studied conventional biology courses and third, others who have

studied (one of the versions of) the new BSCS biology courses. Colleges will need to concern themselves with these three populations and it is suggested that the differences between the first two and the third will be of great significance. Collegiate biology departments will need to prepare for these students. One thing is certain: continuation in offering the standard introductory courses will not be the solution.

How much time do the colleges and universities have to prepare for the reformation of their own courses? While a handful of BSCS youngsters will enter college by the falls of 1962 and 1963 (a few took biology in the 11th and 12th grades), the first wave will not reach the campuses until the fall of 1964. By then, if 40% of BSCS students matriculate in college, there will be about 5500 young men and women in the freshman class with a background in the new biology. By 1965 there will be 20,000 and, presumably, the numbers will increase in the succeeding years (see Fig 2). Add to these considerations the likely probability that many of these students will also have experienced the newly developed secondary school courses in physics, mathematics and chemistry.

What should the colleges and universities do? It would be both presumptuous and premature to make specific suggestions here. Perhaps a well-supported representative study group of informed and experienced people will make such suggestions during the months ahead. Professors in biology departments should, regardless of the possible emergence of such a committee, be as informed as possible about the new developments in high school biology and, based on such information, should begin to prepare for these new students. The college biologists could begin by studying the new BSCS *High School Biology* books; by reading the BSCS *Newsletters* (which are free upon request); by visiting nearby high school classes using BSCS materials; and by discussing the development of the program with colleagues of theirs who have been participants in BSCS activities.

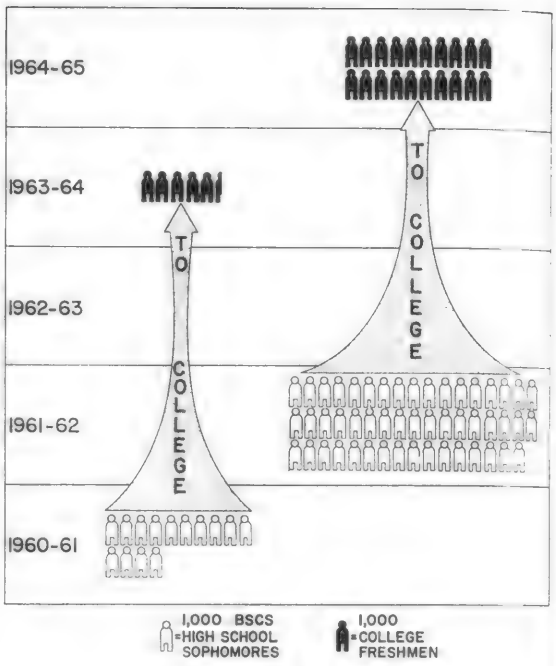

Fig. 2

For the colleges to be unprepared for these students would be a great tragedy. It would be a tragedy not only for the students but for the science of biology as well. There would be no surer way of depriving biology of promising scholars than by offering standard introductory courses to these well-prepared students.

In pursuing its goals to improve high school biology, the BSCS is creating difficult and challenging problems for collegiate departments of biology. This is a healthy situation and we offer no apologies.

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Aid is given to basic biological and medical research activities

John T. Wilson
*University of Chicago**

Support of Research by NSF

IT HAS BEEN SEVERAL YEARS (*AIBS Bulletin*, Oct. 1954) since readers of the *Bulletin* have been given a direct report on the biological and medical science programs of the National Science Foundation. A recent article (*AIBS Bulletin*, April 1961) reviewed various Foundation fellowship programs in the life sciences. The present work is, in a sense, a companion piece covering support of research activities in the same general areas.

Background

As defined by the Congress in the N.S.F. Act of 1950, and as reaffirmed by Executive Order 10521 of March 17, 1954, the Foundation has several functions, the two predominant ones being (1) the support of basic research and science education and (2) the development of national science policy. Numerous actions have been undertaken by the Foundation in support of its broad charter, and an organization even more complex than that outlined in the original legislation has evolved to carry out the responsibilities inherent in its functions (*Science*, May 6, 1960). However, the present discussion will be limited to the basic research support function. This is reflected in various programs of the Biological and Medical Sciences Division—one of three divisions (Mathematical, Physical and Engineering Sciences Division, and the Division of Social Sciences being the other two) whose primary function is the support of scientific research.

Historically, the Foundation had two divisions covering biological and medical science areas: a Division of Biological Science and a Division of Medical Research. After some three years of operation, it had become apparent that there was little reason to separate basic biological and basic medical research, and the two were merged by action of the National Science Board. The merger had no effect upon the breadth of Foundation support of biological and medical research, which, from the beginning, ranged from the structure of biologically important molecules to physiological psychology.

With specific reference to the scope of the medical science program, the Foundation, even during the period of the existence of the Division of Medical Research, did not support disease-oriented or clinically-oriented fields. A statement by the Director in late 1951 made this point clear:

> "The Foundation . . . believes that its role with relation to the medical sciences should be the support of basic research in the preclinical fields such as anatomy, physiology, biochemistry, microbiology, pharmacology, etc. . . . It is quite likely that no distinction will be made program-wise between basic research in the medical sciences and basic research in the biological sciences."

Also on the basis of an early Board policy, it was decided not to support applied research in agricultural science fields, but to encourage fundamental research in those areas.

Organization and Operation

The programs of the Biological and Medical Sciences Division are organized under eight broad "areas" as follows: *Developmental Biology, Environmental biology, Genetic Biology, Metabolic Biology, Molecular Biology, Regulatory Biology, Systematic Biology,* and *Psychobiology.* Within each area the programs are sufficiently broad and flexible to include support of research, conferences, equipment, travel to international scientific meetings and other miscellaneous scientific activities. To round out the Division's organization, support of specialized research facilities and other activities that fall outside of the indicated program areas are handled within a unit entitled *Facilities and Special Programs.*

The Division's somewhat unorthodox program organization was devised with several thoughts in mind. First of all, experience at the Office of Naval Research with a classical disciplinary concept did not seem to those of us who joined the Foundation in its early days to be a very satisfactory approach to the support of

* Formerly at NSF as Assistant Director of the Biological and Medical Sciences Division.

basic research in biological and medical sciences. It was our hope to transcend traditional disciplinary barriers, not just for the sake of transcending them, but because basic research problems did not appear to us to fit disciplinary boundaries. Secondly, it was our hope to minimize the traditional bifurcations of biology into plant and animal "kingdoms." Modern conceptions of evolutionary and living processes seemed to indicate that plants and animals are not so neatly differentiated as classical views might lead one to believe. Taking all of this into consideration the Division, with some trepidation, adopted the indicated "functional-level" approach which, with some ingenuity, has encompassed all of the basic biological and medical science research problems which have thus far come to our attention. As a secondary gain, the program organization has been useful as an educational device to stimulate interaction between our "departmentalized" academic colleagues who serve on advisory panels.

The Division employs three "closing dates" a year for the receipt of research proposals (September 15, January 15, and May 15), timed to accommodate a tri-semester system within colleges and universities (thinking of the summer session as a third semester). The term "closing date" is used advisedly inasmuch as the dates are not *deadlines* in the strict sense of the word. Proposals which for emergency or other good reason should be processed "out of turn" are so handled. The primary purpose of the closing-date system is to collect at a given point in time a sufficient sample of proposals to enhance the reliability and validity of judgments of advisory panels and staff. Requests for support of activities other than research, i.e., travel, facilities, etc., are normally controlled by specifically announced closing dates rather than by the three which are utilized for receiving research proposals.

The day-to-day operations of programs under each broad area are the responsibility of a Program Director, an Associate or Assistant Program Director, and a secretarial staff. From year to year, approximately half of the Program Directors within the Division are recruited on a sabbatical or leave-of-absence basis from universities or colleges. As a supplement to this "rotational" scheme, a "sabbatical" program has been initiated as a means of "refreshing" the more permanent Program Directors in their areas of competence. All programs function with the assistance of advisory panels which meet shortly following closing dates, primarily for the purpose of reviewing research proposals which have been submitted. The high quality of Division support programs is in large measure a direct function of the generous effort of the scientists who comprise these as well as *ad hoc* advisory groups. The review of the policies of the Division as a whole is the responsibility of a Divisional Committee, a statutory group appointed by the National Science Board. The Divisional Committee meets three times each year and serves as a direct link between Foundation policy making and the scientific community.

Programs

Research Grants. The basic research support program is, of course, the backbone of Division activities. We are pleased to report that over the years there has been an increasing flexibility and variety in the types of "projects" supported, with a strong trend toward programmatic support, through what is called by the Foundation "coherent area" grants. To illustrate the diversity of support which characterizes the research program, the Division during the last year initiated grants ranging from an "individual" summer research project at the level of $300, to a "coherent area" grant in the amount of $700,000 for a period of five years. Insofar as the "form" of grants is concerned, the Foundation has progressed to a point where, with a little imagination, any worthy research proposal which is presented to the Biological and Medical Sciences Division can be supported.

With reference to the philosophy of operation of the research grant program, it has been continuously adaptive in response to many factors. The Foundation (and hence the Division) historically approached the support of research essentially by relying upon the scientific community to initiate proposals which, after evaluation, were selectively supported. From time to time, *ad hoc* studies of special areas were initiated and support programs started as a result of the study (biological field stations, for example). Within the recent past, there has been a sharp rise, partly through natural evolution and partly through astute promotion, in expressions of concern over the lack of support for particular areas of science which, for one reason or another, are "emerging" in importance. In response to what we hope are the most valid of these expressed needs, the Division spent considerable time during the last year examining its programs and exploring ways and means of responding to special requirements of particular areas within the biological and medical sciences. As a consequence, studies of three "special areas" have been made: biological oceanography, computers in life science research, and tropical botany. In the latter two cases, conferences were supported to review needs, and in the case of biological oceanography, an *ad hoc* committee, supported by staff assistance, tackled the problem of Foundation responsibility in this area.

The size of the Division's research grant effort may be of interest. In the past fiscal year, some 2000 proposals were received, their total value being approximately 90 million dollars. From these proposals 900 grants were made in a total amount of approximately 26 million dollars. It is obvious from these figures that the Division supports less than half of the research proposals which it receives. In terms of funds requested, the Division is supporting less than 30 per cent of the total dollar value. In arriving at a decision to support proposals at a dollar level less than that requested, an attempt is made to keep the *annual rate* of support near to the figure requested. Thus, reductions are made where possible by giving support for a shorter period of *time* than that desired. The present average duration of grants is approximately two years and the average annual rate of support is approximately $20,000. The Division's program represents approximately 20 per cent of the total Federal expenditure in the extra-mural support of basic research in the life sciences.

From time to time, interest has been expressed in the extent of support for biological research in the "small colleges" and the "less prominent" universities. We have broken out figures on the support of research at these types of institutions on the basis of grants awarded by the Division last fiscal year. Of the some 900 grants made, 55 were to small colleges in a total amount of approximately $1,050,000. Within the category of small colleges are such institutions as Dartmouth, Reed, Amherst, Wilkes, Canisius, Carleton, Calvin, Hanover, Albion, and the like. To the group of "less prominent" universities, 112 grants were made in a total amount of funds slightly under 2 million dollars. Within the category of "less prominent" universities are included such schools as Idaho State, Lincoln University, University of Vermont, and the University of Mississippi.

Specialized Facility Support. Early in the history of the Biological and Medical Sciences Division, support was initiated for the operation of biological field stations and for specialized research facilities such as the White Mountain High Altitude Station, the Marine Biological Laboratory at Woods Hole, and the Earhart Laboratory at the California Institute of Technology. Proposals were given *ad hoc* review and grants were administered by the most appropriate research program, with support coming out of general appropriations. In fiscal year 1958, funds were requested and appropriated for facility support. Subsequently a program office was organized for the administration of these funds.

Facility support in the Biological and Medical Sciences Division has been limited to "specialized" research facilities. Although never rigidly defined, the concept of "specialized facility" generally means one which is unique in some sense, either in its program or in its location, and one which is not found in the usual university or college departments covering the life sciences. The concept was developed prior to the time when the Foundation provided funds for the renovation and construction of graduate departmental research laboratories and is largely restricted to field stations, systematic biology museums, marine stations, and other "specialized" research institutions.* Specific mention might be made here of the problem of *research equipment* requests, which sometimes are thought of as "facilities." These are conceived of in B&MS Division programming as being integral parts of *research enterprises*, and are considered as falling within the scope of *research support programs*.

The size of the Specialized Facility Program over the last three fiscal years has been at approximately a 2-3 million dollar level. While this has not allowed extensive facility support, it has made possible assistance to a wide variety of biological laboratories. One of the larger grants made by the Division in its Facility Program was to the University of Wisconsin for the support of a controlled environment laboratory. As an example of Division response to a special problem area, the issue of large controlled environment laboratories had been discussed over several years and an extensive effort had been made through the use of special advisory panels to evaluate the need for a second such university laboratory within the country (the first one being the Earhart Laboratory at Cal Tech). It was felt that the Cal Tech "phytotron" had provided much basic information in the field of interaction of plants with their environment. Foundation advisors believed that the same type of approach applied to animal studies. In the decision to activate the Wisconsin grant, major consideration was given to the desirability of encompassing research on animals, as well as plants, under controlled environment conditions. It is anticipated that the Wisconsin facility will approach the status of a "national" or "regional" laboratory with access being provided to competent investigators from other institutions. The enterprise is regarded as a full-scale trial on behalf of the biologists of the United States, which we hope will demonstrate the scientific potentiality of controlled environment research, particularly in the area of animal experimentation.

A recent important development in the Division's facility support effort is in the area of biological oceanography. During the past fiscal year, the Foundation made an award to the Hopkins Marine Station at Stanford University for the expansion of the marine biological program at the Station, including funds for the conversion of the *Pioneer*, a two-masted schooner which, when refitted, will be utilized in biological oceanographic research in the North Pacific area and in the Indian Ocean. A second large grant made funds available to Duke University for expanding the biological oceanographic program at the Marine Laboratory, Beaufort, North Carolina. This grant provides for the design and construction of an ocean-going vessel for use in biological oceanography research and training.

Research Training. In addition to the production of research *per se*, the research grant program contributes importantly to the training of both predoctoral students and postdoctoral research associates. Currently, about 650 research assistants and 300 research associates are supported annually from funds made available through research grants.

In addition to training received through research grants, the Division supports short-term research for medical students as a part of its research training effort. In response to invitations to the Deans of Medical Schools, formal proposals are received each year requesting such support. Following evaluation by an *ad hoc* advisory panel, grants are awarded. In keeping with established practice for such grants, all are of three years' duration. This program now has 68 active grants for research training of medical students in as many medical schools throughout the country.

As another special research training effort, the Biological and Medical Sciences Division maintains a support program for summer activities at biological stations, including marine, fresh-water and field stations. This program was initiated in 1954 following study of the general field station problem by an *ad hoc* committee. Currently, ten programs are being supported at such stations as the Marine Biological Laboratory at Woods Hole, the University of Minnesota's Itasca Sta-

* The Foundation, under its Office of Institutional Programs, now has a "matching" (50-50) grant program for the construction and renovation of graduate level (Ph.D.) laboratories.

tion, the Douglas Lake Station of the University of Michigan, and the Gulf Coast Station.

Collateral Programs Relating to Research. The Division supports a variety of collateral activities that relate to research. Among these are conferences, workshops, symposia, international travel and specialized publications. Last year the Division underwrote approximately 25 conferences and symposia of great variety, including for example, the annual Growth Symposium, a series of regional conferences in developmental biology, a series of workshops on antibody synthesis and characterization, and the 10th Pacific Science Congress.

Travel to congresses and other international meetings held outside of the continental limits of the United States also is supported. Last year, through the Division's travel grant program some 300 biological and medical scientists were enabled to meet with foreign colleagues in more than 20 different settings.

The support of primary and secondary publications has been assumed recently by the Foundation's Office of Science Information Service (OSIS). However, subject matter aspects of this program still are referred to the Division, and through this cooperative effort with OSIS many specialized biological publications, particularly systematic biology monographs, are assisted toward publication each year. In addition to the interaction between B&MS and OSIS which results from the support of publications, many other aspects of science information exchange, such as participation in the Biological Sciences Information Exchange, are a part of the joint effort of the Division and the OSIS.

Role of Professional Staff in the Support Programs. We have already indicated above the general responsibility of the Program Director and his professional colleagues to the research grant and other support programs. In addition to these general responsibilities, professional staff members participate in a large number of extracurricular functions in their areas of competence stemming directly from their roles as scientists. Within the limits imposed by conflict of interest statutes, Program Directors teach seminars in the local universities, participate as members of the governing boards of scientific societies, serve as members of the editorial boards of scientific publications, etc.

A major staff activity is travel, particularly in connection with the research support program. The Division is characterized by an effort to promote close personal relations between the Foundation and the scientific community. Concomitant with the growth of the Foundation, extraordinary emphasis and effort have been made to preserve the personal aspect of our research support program. As the volume of research applications increases, it is necessary in our opinion to have more field contact. No amount of panel discussion or correspondence can substitute for direct interaction with scientists in order that the Foundation understand their problems and objectives.

Being knowledgeable about the programs of other Government agencies is also an important aspect of staff functions. It is normal procedure for Program Directors to exchange visits with study section secretaries at NIH and with branch heads at ONR at the time of panel and study section meetings. While AEC does not utilize a panel system, opposite members of AEC Biology and Medicine staff are invited to participate in NSF panel meetings. Such regular interactions are supplemented by *ad hoc* contacts in both government and private agencies which support biological and medical research. In general, these personal contacts as well as the exchange of information which is afforded by the existence of the Biological Sciences Information Exchange ensure excellent communications between the Division and other government, as well as private, support agencies.

Prospectus

It should be apparent to those readers whose acquaintance with the Foundation dates from the time of its infancy, that there has been some proliferation in its support activities over the past few years. Not only have program dimensions multiplied, but the administrative flexibility with which programs can be handled has greatly increased. It is our hope that the changes have permitted the Biological and Medical Sciences Division to respond more readily and more meaningfully to the needs of the scientific communities which it serves.

As for the future, taking fiscal developments into consideration first, it is hoped that support of research will be enhanced through increased appropriations to a point which will allow considerably greater satisfaction of the demands being made of the Division than is presently the case. Annual increments for the support of research have not kept pace over the past few years with the rate of increase for the budget of the Foundation as a whole. This discrepancy is accounted for by the fact that during this period the Foundation has launched new programs such as the support of specialized research facilities, the renovation of graduate level laboratories, and a program of institutional grants, to name but three. It is hoped that future years will see increases in funds for support of basic research to an extent which will allow for funding of at least 50% of the dollar value of new proposals and 80% of the dollar value of requests for continuing support.

In terms of the qualitative characteristics of research support programs, the future will unquestionably see the Foundation, and in turn the Biological and Medical Sciences Division, utilize broader, programmatic-type grants. This trend will occur as a function of increased funds, but it will also occur because of the desire on the part of the Foundation to supplement project-type support activities. Thus, the future should see an increasing number of "coherent area" grants which give considerable latitude to principal investigators with respect to the use of funds at the local level for all types of needs. Programmatic grants will be particularly useful in supporting with a single award the variety of activities at institutions such as marine and field stations. As we view general administrative change within the Division's support programs, the trend seems to be in the direction of fuller use of staff for research proposal evaluation, particularly in the case of proposals which are in the lower ranges of funding, and for support of scientists of undisputed stature.

(Continued on page 31)

Nuclear energy is used in Latin-American agricultural studies

Howard Boroughs
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Interamerican Institute of Agricultural Studies

Radiation Research at a Tropical Center*

INTEREST in the peaceful uses of nuclear energy is by no means a monopoly of those countries which are able to supply one Geiger counter for every student. The so-called less developed countries are also very much concerned, and some of them have programs which are perhaps overambitious at present.

In this hemisphere, interest in nuclear energy has resulted in the formation of an Interamerican Nuclear Energy Commission which is composed of representatives from the 21 member nations of the Organization of American States. The Interamerican Institute of Agricultural Sciences is a part of the Organization of American States and for the last 15 years has been concerned with raising the level of agricultural education in Latin America. Its headquarters are in San José, Costa Rica, and the Tropical Center for Research and Graduate Training is in Turrialba, Costa Rica. The Tropical Center is primarily a graduate school, although it offers short courses of several weeks to several months duration, on such subjects as coffee, cacao, pastures, extension, and quarantine procedures.

As a result of the suggestions of Dr. Milton Eisenhower, who has long been concerned with Latin American affairs, the U. S. Atomic Energy Commission in 1957 signed a contract with the Institute to encourage the use of nuclear energy in solving problems relating to agriculture in Latin America. In 1958 the technical staff was hired, and the installation of the first gamma field in Latin America was completed.

The Nuclear Energy Program of the Tropical Center has so far been interpreted as one of training in its broadest sense. This program is essentially equivalent to the work being done by the Nuclear Energy Department which was established at the Tropical Center to accommodate the A.E.C. grant. Courses are offered in cytogenetics, plant breeding, advanced laboratory techniques, soil chemical analysis, entomology, and the use of radioisotopes. Research is obligatory. The students, who stay at least one year to get an advanced degree, are encouraged to use the library, which is probably the best in its field in all Latin America. A library is such an obvious part of graduate training in the United States that it was something of a shock to learn that some students who come to Turrialba from Latin American countries don't know what a library is for. It is a common idea that a library is a room to put books in, while to a person actively engaged in research, a library ought to be a room where one goes to take books out. Finally, training involves the emphasis on original and critical thought in place of the authority of the printed word.

The program at present consists of geneticists who make use of a 1300 curie cesium 137 gamma source in a six-acre field, and scientists who make use of radioactive tracers in studies of soil-plant relationships, or in plant physiology and biochemistry. An entomologist has just joined the staff, and this person will use radiation to study the possibility of insect eradication in the tropics, or tracers to study insect metabolism.

A new plant science building which should be finished in 1962 will greatly increase our physical facilities, and will permit us to accept more students for training. A water pool irradiator has been built next to the cytogenetics wing, and it is expected that 2000 curies of cobalt will be installed. This irradiator will be used for seed and insect irradiation, but it can also be used for studying tropical food preservation in the future.

Research in the program is both basic and applied. Since the major difference between the two is one of motivation, we feel that a happy combination will keep everyone happy. The Institute as an international organization is naturally under some pressure to study problems of country A which may be of no concern to country Z. As a graduate school, some members of the staff feel we should offer training in such subjects as pathology, genetics, or physiology, rather than emphasizing, for example, coffee pathology, cacao genetics or sugar cane physiology. Finally, the personality of the individual scientist is involved, for one will want to study basic radiobiology, while another may be more

* This paper was prepared with the aid of A.E.C. Contract AT(30-1) -2043.

concerned with getting a strain of disease-resistant rice. The program is flexible enough to allow a large amount of individual freedom to both students and members of the staff, and we are grateful to the U. S. Atomic Energy Commission for this freedom.

Since research work was begun, we have studied, or are studying, the following subjects:

1) The effect of surfactants on foliar nutrition of coffee and cacao using p^{32}.

2) The mechanism of foliar nutrition using p^{32} and $S^{35}O_4$.

3) The metabolism of radiosucrose by coffee leaves.

4) The intracellular localization of $zinc^{65}$ in plant cells.

5) The protein metabolism of rice grains using C^{14} glutamic acid.

6) Phosphate availability and fixation in tropical soils using p^{32}.

7) The region of ion absorption by mature coffee tree roots using Rb^{86}.

8) The amino acid content of seeds which show endogenous yearly rhythm in germination.

9) Radiosensitivity of coffee, cacao, rubber, banana, grasses and palms.

10) Cytogenetics of irradiated cacao.

11) A comparison of the effects of gamma rays and thermal neutrons on the production of mutants in coffee and *Crotalaria*.

12) Mutation breeding in grasses, rice, sesame, and cotton.

13) Non-random distribution of chiasmata in rye, coffee and *Crotalaria*.

It is extremely encouraging to note the enthusiasm with which the students return to their home countries to use the knowledge they have gained at the Institute. Not all of them have been fortunate enough to find the equipment needed to continue work with radioisotopes, but at least we are helping to form a body of scientists who are aware of the hazards and delights of life with radioactive atoms.

FIG. 1. *The Tropical Center for Research and Graduate Training of The Interamerican Institute of Agricultural Sciences, Turrialba, Costa Rica. Main building.*

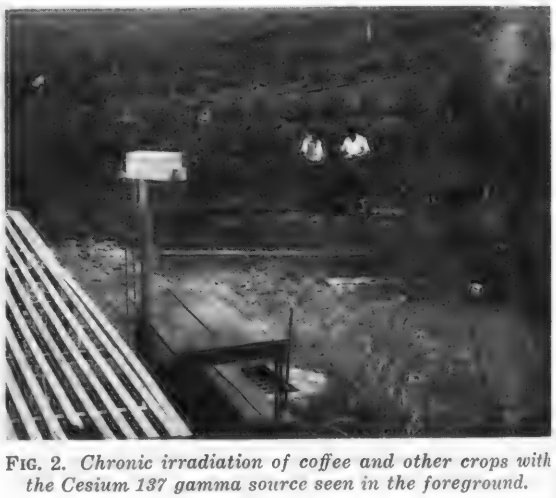

FIG. 2. *Chronic irradiation of coffee and other crops with the Cesium 137 gamma source seen in the foreground.*

THE WILDLIFE DISEASE ASSOCIATION announces a 1st International Conference on Wildlife Disease sponsored by the National Institutes of Health and conducted under the auspices of the American Institute of Biological Sciences. The conference will be held on June 25-27, 1962 at the Sha-wan-ga Lodge, High View, New York.

Topics and Session Chairmen

POPULATION PRINCIPLES, David E. Davis, President, Wildlife Disease Association.

EPIZOOTIOLOGY OF ANIMAL PARASITE INFECTIONS, Carlton M. Herman, Fish and Wildlife Service.

EPIZOOTIOLOGY OF VIRAL AND BACTERIAL INFECTIONS, Col. Edward Buescher, Chief, Walter Reed Army Institute of Research.

PHYSIOLOGY (including stress), John J. Christian, Penrose Research Laboratory, Philadelphia Zoological Garden.

BIOLOGICAL CONTROL, Carl B. Huffaker, University of California.

RADIOECOLOGY AND POLLUTANTS, John R. Tester, University of Minnesota.

PATHOLOGY, Charlie N. Barron, Pathology and Toxicology Section, Smith, Kline & French Laboratories.

Additional information will be published in forthcoming issues of the AIBS BULLETIN.

A strong faculty versus university location in the production of oceanographers

Louis S. Kornicker
Agricultural and Mechanical College of Texas

Inland Education of Oceanographers

A SURVEY conducted by the Committee on Oceanography of the National Academy of Sciences—National Research Council in order to estimate the present status of the marine sciences in the United States resulted in a report that stressed the need for an acceleration of the national effort in basic and applied research in oceanography (1).

The committee made many recommendations for implementing the proposed acceleration of oceanographic research. One of these, a recommendation concerning the establishment of new centers for oceanographic education is stated as follows:

> "It may be desirable to develop oceanographic education at new centers. However, a 'critical mass' of faculty in the basic sciences is essential for successful teaching of oceanographers. Such new centers should, therefore, be developed at universities which possess strong faculties in the sciences."

Although the presence of a ". . .'critical mass' of faculty in the basic sciences . . .", is pointed out by the NAS-NRC committee as being essential for successful teaching of oceanographers, the geographic location of new centers is not considered. On a geographic basis a natural conclusion would seem to be that the all new centers should be located at universities in marine states, so that the scientists are close to the ocean. However, a question that arises concerning the location of new centers is this: Would an inland university, with a "critical mass" of faculty in the basic sciences, produce more oceanographers than a university in a marine state that has less scientific educational strength? The present report is an attempt to evaluate the relative importance of a strong science faculty and geographic location on the production of oceanographers.

An estimate considered to indicate the relative strength in scientific education of each state and Washington, D.C. was obtained by totaling for each state the number of graduate students majoring in biology, chemistry, physics, and geosciences as of April 1, 1958 (2). These totals are listed according to state and relative rank in Table 1.

An estimate considered to reflect the relative potential of each state to produce oceanographers was obtained by ascertaining the number of practicing oceanographers having received their training (final degree) in each state. The identity of practicing oceanographers was obtained from the 1960 *International Directory of Oceanographers* (3), which lists 473 key oceanographers in the United States. Information concerning education for 294 (62%) of the 473 oceanographers listed in the directory was obtained from *American Men of Science* (4). The distribution of 294 oceanographers in this sample is listed in Table 1 according to the state from which they received the final degree.

In Table 2, the number of final degrees awarded to oceanographers in the sample from coastal marine states and from inland states is compared for states having the same relative rank of scientific educational strength (based on number of graduate students in biology, chemistry, physics, and geosciences as of April 1, 1958).

Table 2 shows that within the same rank of scientific educational strength marine states have produced more oceanographers in the sample than have the inland states. The effect of coastal location becomes more pronounced in states of relatively low scientific educational strength.

It is also evident from Table 2 that *inland* states among the top 10 in scientific educational strength have produced as many oceanographers as marine states in the second 10, and more oceanographers than produced in marine states in the 3rd, 4th, or 5th 10. This observation becomes even more remarkable when it is considered that inland universities have not received the financial stimulation from state or federal government that has been received by marine universities and institutes.

Oceanographic education in inland states will serve three purposes:

1) It will increase the number of trained oceanographers produced in the United States. The oceanographers trained at inland universities will supplement those trained at coastal institutes and thus will assist in alleviating the critical shortage of trained oceanographers that now exists.

2) It will provide more university positions for oceanographers. In a report by the Committee on Education and Recruitment of the American Society of Limnology and Oceanography, it is stated that in a survey made by the committee, about 50 per cent of the working force of oceanographers in 1960 were employed by universities or by university-connected research institutes; the balance were employed either by fisheries operating under state or federal auspices or by the U. S. Navy Hydrographic Office (5). Oceanographers employed by other governmental agencies such as the Coast and Geodetic Survey, Beach Erosion Board, Weather Bureau, Atomic Energy Commission, and the Food and Agricultural Organization of the United Nations, or by petroleum, aircraft, marine construction, electronics, and instrument manufacturing companies were not counted in the survey. If all oceanographers in government and industrial employ had been included in the survey, it is probable that considerably less than 50 per cent of the oceanographic working force would have been shown to be in the employ of universities. Many oceanographers (perhaps as many as 90 per cent) who are employed by universities or university-connected research establishments do not have academic positions. So, although a critical shortage in oceanographers exists today, academic positions are scarce. Students who obtain a Doctor of Philosophy degree often do so partly because of a desire to teach in a college or university. This desire can not be fulfilled as easily with a degree in oceanography as with a degree in a different scientific discipline. The teaching of oceanography at inland universities and colleges will provide more teaching opportunities in oceanography.

3) It will increase the volume of oceanographic research conducted in the United States. Teachers of oceanography in inland universities will conduct research in oceanography in the accepted university tradition of combining research with teaching. According to Dr. Arthur E. Maxwell, head of the geophysics branch of the Office of Naval Research, "A wealth of scientific talent existing in inland research institutions could be used to support actual oceanographic work on the high seas. With the increasing interest in oceanography, more capable scientists are needed to bolster the relatively small rank of oceanographers now probing the oceans" (6). An increase in the number of inland

Table 1. *Number of Graduate Students In Biology Chemistry, Physics and Geosciences In Each State As Of April 1, 1958, And Number Of Oceanographers In Sample Obtaining Final Degree In Each State*

State	Location	Number of Graduate Students in Biology, Chemistry, Physics, Geosciences	Rank	Number of Oceanographers in Sample Obtaining Final Degree in Each State
New York	Marine	4,020	1	23
California	Marine	2,745	2	88
Illinois	Inland	2,318	3	21
Pennsylvania	Inland	2,109	4	6
Michigan	Inland	1,645	5	4
Massachusetts	Marine	1,610	6	38
Ohio	Inland	1,414	7	8
Wisconsin	Inland	1,349	8	6
Texas	Marine	1,173	9	10
Indiana	Inland	1,139	10	0
Iowa	Inland	917	11	2
New Jersey	Marine	904	12	5
Maryland	Marine	806	13	8
Washington	Marine	783	14	17
Minnesota	Inland	774	15	1
Kansas	Inland	726	16	0
North Carolina	Marine	631	17	4
Florida	Marine	559	18	8
Missouri	Inland	539	19	1
Washington, D.C.	Inland	514	20	2
Connecticut	Marine	510	21	22
Tennessee	Inland	472	22	0
Colorado	Inland	469	23	1
Utah	Inland	461	24	0
Oklahoma	Inland	439	25	0
Oregon	Marine	408	26	1
Nebraska	Inland	311	27	1
Arizona	Inland	301	28	0
Virginia	Marine	301	29	1
New Mexico	Inland	283	30	1
Kentucky	Inland	275	31	0
Alabama	Inland	257	32	0
Louisiana	Marine	221	33	6
Delaware	Marine	197	34	0
Georgia	Marine	188	35	1
Rhode Island	Marine	185	36	5
West Virginia	Inland	160	37	0
Arkansas	Inland	148	38	0
New Hampshire	Marine	107	39	1
South Carolina	Marine	94	40	0
Wyoming	Inland	94	41	0
Mississippi	Marine	91	42	1
Hawaii	Marine	81	43	0
Montana	Inland	77	44	0
North Dakota	Inland	72	45	0
Idaho	Inland	70	46	0
South Dakota	Inland	67	47	0
Maine	Marine	60	48	1
Vermont	Inland	40	49	0
Nevada	Inland	39	50	0
Alaska	Marine	6	51	0

Table 2. *Number of Oceanographers Obtaining Final Degrees From Marine States And Inland States*

Rank	Marine States	Inland States	Ratio Marine: Inland
1–10	159	45	3
11–20	42	6	7
21–30	24	3	8
31–40	12	1	12
41–51	2	0	

(Continued on page 31)

THE EDITOR'S DESK

Information on women scientists and the potentialities of science as a career for women are contained in *Women in Scientific Careers*, a report just issued by the National Science Foundation. The report is a compilation of available data on the training and employment of women in various scientific fields, and a brief study of the factors controlling women's selection of and participation in scientific careers. Copies are available from the Superintendent of Documents, U. S. Government Printing Office, for 20 cents.

Establishment of a **Science Resources Planning Office** in the National Science Foundation is announced by Dr. Alan T. Waterman, NSF Director. The Office will serve as a focus for studies of the nation's future needs and resources for research and education in science. Dr. Richard H. Bolt has been named to head the SRPO and to occupy a new Foundation position, Associate Director (Planning). Since January, 1960, Dr. Bolt has served as NSF's Associate Director (Research).

The Public Health Service, through its Division of Water Supply and Pollution Control, will offer a **1-week training course,** "Recent Developments in Water Bacteriology," February 5-9, 1962, at Cincinnati, Ohio. The course is designed for professional bacteriologists and others in positions of responsibility in state, municipal, and other laboratories engaged in bacterial water analysis. Full descriptions are given in the *Training Program Bulletin* which is available on request. Applications, or requests for information, should be addressed to the Chief, Training Program, Robert A. Taft Sanitary Engineering Center, 4676 Columbia Parkway, Cincinnati 26, Ohio, or to a PHS Regional Office.

Research and development performed by private industrial firms in 1960 amounted to $10.5 billion, the **National Science Foundation** reports. This represented a 10-percent increase over the $9.6 billion total for 1959. Of the $10.5 billion, 58 percent was financed by the Federal Government.

The Tenth Pacific Science Congress has recognized the need and value, and fully endorses the establishment of a **United States National Tropical Botanic Garden in the State of Hawaii;** and recommends to the authorities, both Federal and State, that they do all in their power to establish such a garden.

The new address of the **American office of the Academy of Zoology** (Agra, India): is: John M. Condit, F.A.Z., Deputy Secretary-Treasurer, The Academy of Zoology, 285 East 15th Avenue, Columbus 1, Ohio.

Dr. Luis J. Archer was recently appointed Editor of the **Journal of Biology *Broteria.*** This is an international journal, founded in 1902. *Broteria* is issued quarterly, and is devoted to the publication of original papers pertaining to taxonomy, physiology, cytology, genetics and other subjects of biological interest. The articles are presented in English and in other languages of the scientific world. Manuscripts and communications on all editorial matters are to be sent to the Editor, Luis J. Archer, Instituto Nun'Alvres, Caldas da Saude (Minho), Portugal. Subscriptions and exchanges are handled by the Administrator, Januario Geraldes, R. Maestro Antonio Taborda 14, Lisboa 3, Portugal.

The National Science Foundation has recently published a study which shows that about 331,000 scientists and engineers were employed in research and development work in the United States in 1958, an increase of 48 percent over the 223,000 in 1954. These and other figures in the study now make it possible to evaluate recent changes in the national R&D manpower picture. The study, "Scientists and Engineers in Research and Development, 1958," is No. 29 of the series *Reviews of Data on Research & Development.*

A "Developmental Council" has been established to represent the interests of the developmental biologists of the United States. The three organizations represented by the Developmental Council are the Society for the Study of Development and Growth, the Division of Developmental Biology of the American Society of Zoologists, and the Development Section of the Botanical Society of America. The Developmental Council consists of three members, one from each of the participating organizations. The specific current purposes of the Council are to co-ordinate joint meetings (as recently held with the AIBS), advise government agencies and panels upon request, and to represent on the AIBS. Governing Board the interests of developmental biologists through the AIBS representative of the Society for the Study of Development and Growth.

Grants

Applications are invited for two Turtox Scholarships established by **General Biological Supply House, Inc.** The stipend of each scholarship is $5,000. Eligible for consideration for an award is any citizen of the United States of America who is currently, or who has been, enrolled in a graduate school and who is, or is contemplating, continuing study for the doctorate degree in botany, zoology, or biology. Awards will be based upon evidence bearing upon the promise of the applicant as a prospective teacher and research scholar. The last date for receiving applications will be February 1, 1962. Application blanks may be requested from the Chairman of the Award Committee, Professor Frank A. Brown, Jr., Department of Biological Sciences, Northwestern University, Evanston, Illinois.

The Executive Director of the **Air Force Office of Scientific Research** (AFOSR), Dr. Knox Millsaps, has announced the awarding of more than 2-million dollars in basic research grants and contracts since September. These most recent awards went to 43 universities, colleges, non-profit research institutions and industrial laboratories in the United States and to two Canadian universities. AFOSR has awarded 79 basic research grants and contracts valued at almost 3-million dollars so far this fiscal year.

A new policy designed to help scientific journals meet their costs in publishing research results has been adopted by the **Federal Council for Science and Technology.** Under the policy, which has been followed by some Government agencies in the past and is now standard for all, page charges for publication of scientific research results in scientific journals will be budgeted for and paid as a necessary part of research costs under Federal grants and contracts.

The National Science Foundation announces that final proposals for Antarctic research for the 1962-63 field season should be submitted by February 15, 1962, in order to allow the

necessary time for scientific review and field planning. Proposals should be addressed to the Director, National Science Foundation, Washington 25, D.C., Attention: Office of Antarctic Programs.

The Division of Biological and Medical Sciences of the **National Science Foundation** announces that the next closing date for receipt of basic research proposals in the life sciences is January 15, 1962. Proposals received prior to that date will be reviewed at the spring meeting of the Foundation's advisory panels and disposition will be made approximately four months following the closing date. Proposals received after the January 15, 1962 deadline will be reviewed following the summer closing date of May 15, 1962. Inquiries should be addressed to the Biological and Medical Sciences Division, National Science Foundation, Washington 25, D.C.

The National Institutes of Health, the **Public Health Service** research center at Bethesda, Maryland, today reported that 3327 research grants and 300 fellowships totaling $73,727,529 were awarded during September, 1961. Of the total, $30,078,923 was allocated to support 1231 new research grants and fellowship awards. The remaining $43,648,606 was for the continuation of 2213 previously approved research grants totaling $42,823,240 and 183 fellowships totaling $825,366.

Notes on Biologists

Dr. William P. Jacobs of the Biology Department, Princeton University, and President of the Society for the Study of Development and Growth, will be spending a leave-of-absence during the spring and summer of 1962 at Oxford University, Oxford, England, working on the movement of radioactive plant hormones and weed-killers with G. E. Blackman's group in the Agriculture Research Unit of the Department of Agriculture.

Biological Abstracts announces the appointments of **Phyllis V. Parkins** as Assistant Director for Editorial Affairs, and **Robert R. Gulick** as Assistant Director for Administrative and Business Affairs.

The American Society of Parisitologists presented its Henry Baldwin Ward Medal during its annual business meeting in August, 1961. The two recipients for this year are: **Dr. Elvio Sadum,** Walter Reed Army Medical Center, and **Dr. Robert A. Rausch,** U.S. Public Health Service. The medal is accompanied by a certificate of designation and the sum of $1,000.

Dr. Carl H. Oppenheimer, former research scientist at the University of Texas marine institute at Port Aransas, has been appointed research associate professor at the Institute of Marine Science, University of Miami, where he now heads the microbiology group.

Dr. George T. Rudkin has been appointed Associate Member of the Institute for Cancer Research, Dr. Timothy R. Talbot, Jr., director of the cancer research center at 7701 Burholme Avenue, Fox Chase, Phila., announced. He formerly held the post of research associate. Dr. Rudkin, who is a geneticist, is currently investigating the chemistry of genes.

Dr. Hans Molitor has been elected president of the Society for Promotion of International Scientific Relations. He succeeds Dr. David Nachmansohn, who has served in this capacity since May 1959. Born in Maffersdorf, Czechoslovakia, Dr. Molitor came to the United States in 1932 to organize and head the Merck Institute for Therapeutic Research. He was director of the Institute until 1956, when he became director of scientific relations of the Merck Sharp & Dohme Research Laboratories, a division of Merck & Co., Inc., Rahway, New Jersey. He retired in 1960.

The State University College of Forestry at Syracuse University announces that **Dr. Bengt Leopold** has been appointed director of the Empire State Paper Research Institute and professor of pulp and paper technology.

Two awards for outstanding achievement in biological research contributing to the advancement of forestry were made to a Canadian and a United States scientist on October 11 in Minneapolis, Minn. The presentations were made by President Charles A. Connaughton of the Society of American Foresters during a combined annual meeting of that organization with the Canadian Institute of Forestry. The awards, consisting of an engraved plaque and a cash honorarium were presented to **Dr. R. E. Balch** of Fredericton, New Brunswick, and **Dr. Paul J. Kramer** of Durham, North Carolina.

Two scientists from the United States —both affiliated with Baltimore institutions—and two from Europe have been named foreign members of the Royal Society of London, the world's oldest Academy of Sciences. The Americans honored by election to the Society were **Solomon Lefschetz,** director of the Center for Differential Equations at RIAS, the Martin Company's basic research center, and **Elmer Verner McCollum,** professor emeritus of biochemistry, The Johns Hopkins University. Both are also members of the National Academy of Sciences in the United States.

At the 16th American Horticultural Congress, held October 25-28, at the Hotel Northampton, Northampton, Mass., winners of outstanding horticultural awards given for their contributions to American horticulture were: **Henry Hohman,** Kingsville, Maryland, nurseryman; **Miss Caroline Dorman,** Saline, Louisiana, an amateur horticulturist; **Professor Clarke B. Thayer,** Amherst University, Amherst, Mass., teacher; **Miss Elizabeth Lawrence,** Charlotte, N. C., horticultural writer and **Dr. A. C. Hildreth,** Denver, Colorado, professional horticulturist. The Congress was sponsored by the American Horticultural Society.

At the business meeting on Friday afternoon, October 27th, **Dr. Donald Wyman,** of the Arnold Arboretum, Jamaica Plain, Mass., was re-elected President of the Society. Other officers elected were **Dr. Henry T. Skinner,** National Arboretum, Washington, D.C., First Vice President; **Mrs. Anne Wertsner Wood,** Swarthmore, Pa., Second Vice President and **Mrs. W. T. Wilson,** Bladensburg, Maryland, Acting Secretary-Treasurer.

ONR Activities

Research Fellowships, supported by a grant from ONR, are offered by the **Scottish Marine Biological Association,** tenable at the Oceanographic Laboratory, Edinburgh. The fellows will work as members of a team using continuous plankton recorders in the north Atlantic Ocean from the American to the European coasts. Fellowships, open to qualified scientists of any nationality, will be awarded initially for one year, but it is hoped that they will be renewed for at least one additional year. Further details can be obtained from the Officer-in-Charge, Oceanographic Laboratory, Craighall Road, Edinburgh, 6, Scotland.

A symposium on Optical Character Recognition will be held on **15, 16, and 17 January 1962.** It will be jointly sponsored by the Information Systems Branch of the Office of Naval Research and the Research Information Center of the National Bureau of Standards. The Symposium will be held in the Department of the Interior Auditorium on C Street, between 18th and 19th Street, N.W., Washington, D.C. Attendance is open to all interested technical and management personnel. Further information and a preliminary Symposium program, when available,

may be obtained by contacting: Miss Josephine Leno, Code 430A, Office of Naval Research, Washington 25, D.C. (Phone OXford 6-6213).

A symposium on Redundancy Techniques for Computing Systems will be held on **6 and 7 February 1962;** sponsored by the Information Systems Branch, Office of Naval Research. This Symposium will be held in the Department of the Interior Auditorium, C Street between 18th and 19th Streets, N.W., Washington, D.C. Attendance is open to all interested technical personnel. Further information and a preliminary Symposium program, when available, may be obtained by contacting: Miss Josephine Leno, Code 430A, Office of Naval Research, Washington 25, D.C. (Phone OXford 6-6213).

Meetings

The Gustav Stern Symposium on "Perspectives in Virology III" has been scheduled for **January 22 and 23, 1962,** in New York City (by invitation). For further information contact: Morris Pollard, University of Notre Dame, Notre Dame, Indiana.

A record total of over 1600 of the nation's soil and crop scientists met at St. Louis, Mo., Nov. 27-30 for the **53rd annual meeting of the American Society of Agronomy.** The meeting included the Soil Science and Crop Science Societies of America. Headquarters were the Sheraton-Jefferson Hotel with programs also at the Statler-Hilton and the Bishop Tuttle Memorial. The ASA last met in St. Louis in 1942. Meeting jointly with the ASA were approximately 150 agricultural meteorologists attending the Fourth Conference on Agricultural Meteorology. This group from the American Meteorological Society had three joint meetings with the agronomists and two single programs.

The University of Arizona in cooperation with Argonne National Laboratory, Argonne, Ill., will sponsor a **symposium on current trends in nuclear power, February 26 through March 2, 1962,** in Tucson. The symposium is intended for scientists, engineers, and technical administrative personnel from universities, research laboratories, and industrial organizations. Dr. Lynn Weaver, Head of the Nuclear Engineering Department of the University of Arizona, is in charge of arrangements.

The first **Southern Forest Tree Physiology Workshop** was held at Clemson College, Clemson, South Carolina, on September 6, 7, and 8, 1961. Twenty-eight invited participants actively engaged in tree physiology research from Maryland to Texas, met to become acquainted with one another's work and to form personal contacts conducive to free exchange of ideas and information among those interested in similar phases of tree physiology research. There were no formal papers presented at the workshop. Each session was a round-table discussion on a general topic led by a moderator, everyone being free to enter into the discussion.

The American Nuclear Society, the Atomic Industrial Forum, Atom Fair, and the National Youth Conference on the Atom met in Chicago during the week of November 6-10, 1961, for the combined **ANS-Atomic Industrial Forum.**

A science-mathematics conference for public school teachers and administrators to review and discuss study programs being developed by national committees was held Saturday, September 30, 1961 at Luther College, Decorah, Iowa. Dr. Bentley Glass, The Johns Hopkins University, chairman of the Biological Sciences Curriculum Study of AIBS spoke, and section meetings were conducted by representatives of the study programs. Dr. Glen E. Peterson, University of Houston, represented BSCS.

The annual meeting of the Biophysical Society will take place Wednesday, Thursday and Friday, **February 14, 15, and 16, 1962,** at the Sheraton-Park Hotel, Washington, D. C. There will be no pre-registration fee. The detailed program of contributed papers will be available about January 15, 1962. For further information, write: Dr. Dean Cowie, Meeting Chairman, Department of Terrestrial Magnetism, Carnegie Institution of Washington, 5241 Broad Branch Road, N.W., Washington 15, D. C.

From the Societies

The Society for the Study of Evolution reports the election of the following new officers: President, W. Frank Blair; President-Elect, John A. Moore; Vice Presidents, I. Michael Lerner, Antonio Brito da Cunha, and N. Tingergen; Secretary, H. H. Ross; Treasurer, Robert E. Beer.

The following new officers have been elected by the **American Society of Limnology and Oceanography, Inc.:** President, Gordon A. Riley; Vice President, John C. Ayres; Secretary-Treasurer, George H. Lauff.

The Society for the Study of Development and Growth announces the election of the following new officers: President, Clifford Grobstein; Secretary, Armin C. Braun; Treasurer, H. Clark Dalton.

OCEANOGRAPHERS *(Continued from page 28)*

oceanographers will increase the scientific talent already available and perhaps will stimulate other scientists to conduct much needed oceanographic research.

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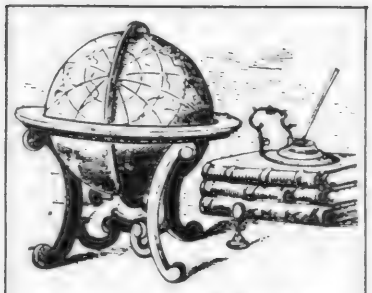
3. National Academy of Sciences — National Research Council. 1960. An international directory of oceanographers. 3rd ed.
4. American Men of Science. 1955, 9th ed. A-R. 1960, 10th ed.
5. Limnology and Oceanography, Suppl. to Vol. VI, Aug. 30, 1960. Education and recruitment of oceanographers in the United States. A report by The Committee on Education and Recruitment, The American Society of Limnology and Oceanography, Inc.
6. Science News Letter. July 22, 1961. Landlocked scientists could explore oceans. 80-61.

NSF *(Continued from page 24)*

Such administrative modifications are designed in part to reduce the burden of proposal reading on advisory panels, and in part to hasten the processing of a significant number of small proposals.

Over and above these developments, we are certain that there will be many unanticipated problems which will require program modifications. It is our hope that the Division will be sensitive to the needs and problems of biological and medical scientists and that the Foundation will be sufficiently flexible to meet them in a manner which will be increasingly satisfactory from the point of view of the scientific community.



AIBS REPORTS

Dr. Hiden T. Cox, Executive Director of the American Institute of Biological Sciences, has been granted six months' leave of absence to undertake a policy-making assignment in the National Aeronautics and Space Administration.

Dr. Cox has been granted leave, effective December 1, 1961, by the AIBS Executive Committee. He will assume duties as NASA's Assistant Administrator for Public Affairs, reporting directly to James E. Webb, NASA Administrator.

Dr. Cox will be charged with developing NASA policies to insure that the character, the intent and the results of America's space effort are correctly and adequately interpreted to the people of this country and the world.

Dr. Tracy M. Sonneborn, Bloomington, Indiana, president of AIBS, said the appointment is a tribute to the creative administration of Dr. Cox, and a recognition of his effectiveness in building AIBS from modest beginnings six years ago into a vigorous national spokesman for biological science.

"The National Aeronautics and Space Administration has apparently joined the tens of thousands of American biologists who recognize in Hiden Cox a top-flight administrator. In the few years he has served as Executive Director, the American Institute of Biological Sciences has grown from a new, small organization struggling for its very survival to a gigantic organization now recognized as one of the major forces in American science.

"Qualities expressed in that accomplishment are presumably the ones NASA recognizes as needed for the rapid and effective development of its public affairs administration," Dr. Sonneborn said.

"The Executive Committee of AIBS has a high opinion of Dr. Cox's services to organized biology in America and is fully aware of the impact of even their temporary loss, during this period of perpetual crisis. The same critical situation, however, forces it to recognize its obligation to accede to the request of the Government to borrow one of the most able science administrators in the country.

"We are fortunate to have in Dr. John Olive, our present Deputy Executive Director, a man who can and will step in effectively to serve as Acting Executive Director of the AIBS during Dr. Cox's absence."

Dr. Cox will direct and coordinate NASA policy concerning dissemination of general and technical information, educational programs, relations with other governmental agencies, with universities and industrial research organizations, and with individual scientists.

Dr. Cox, 44, a botanist with 19 years experience as a college teacher, has been associated with AIBS since its early years within the framework of the National Academy of Sciences-National Research Council.

The AIBS was incorporated as an independent, national nonprofit corporation with its own Governing Board, in 1955. Dr. Cox, who had previously served as an executive of the organization while on a year's leave from duties as professor of botany at Virginia Polytechnic Institute, became the first Executive Director. He has served in that capacity since.

AIBS Publications

Redactory work has begun on manuscripts for the January 1962 issues of *The Journal of Lipid Research* and *The Journal of Wildlife Management.*

The 1962 edition of the *AIBS Publications Catalog* is now available. This catalog lists, with short descriptions, all AIBS Publications. For a *free* copy write the Publications Office, AIBS.

Educational Activities

The MEND (Medical Education for National Defense) program is a joint federal agencies-medical school program designed to better acquaint the medical student with the principles of military and disaster medicine.

The AIBS MEND Speakers Program, supported by the Atomic Energy Commission, provides speakers in various areas of radiation to medical schools which participate under the MEND program.

Travel expenses and honorarium are borne by the AIBS.

More than 135 scientists in 34 states will serve this year as **Visiting Biologist lecturers** and consultants in colleges, small universities and high schools.

The American Institute of Biological Sciences, announcing the fifth year of the program for colleges, said applications for 1961-62 participation are now being received.

The program, supported by grants from the National Science Foundation and the Atomic Energy Commission, provides for visits by prominent biologists for participation in seminars, lectures, consultation with faculty, and scientific or career discussions with students. Visits normally are for three days.

Last year 140 colleges participated.

A similarly supported program for high schools will be operated for the third year. Under this, biologists visited 85 high schools in 29 states during the 1960-61 school year.

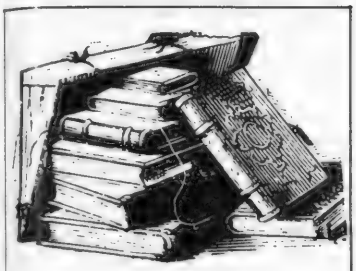
A third program, by which an institution may invite a particular specialist from abroad to visit, will be operated for the second year. This plan allows foreign biologists to visit at least three colleges, laboratories or other scientific centers over a period of a month. Sixty-four institutions participated last year.

Information on all programs can be obtained from Educational Activities, AIBS.

Placement Service

Attention Employers of Biologists and Agriculturalists: Beginning with the November 1961 issue, the Placement Service Directory will be published quarterly (November, February, May and August) at a cost of $8.00 per year. Individual copies may be purchased at a cost of $2.00.

Those **biologists and agriculturalists** who wish to have their curricula vita appear in the February 1962 Placement Directory are urged to register before the *deadline date of January 19, 1962.* Requests should be directed to the AIBS Placement Service Office, 2000 P. St. N.W., Washington 6, D. C.



LIBRARY

One copy of each publication submitted for listing should be sent to the Editor, AIBS BULLETIN, American Institute of Biological Sciences, 2000 P Street, NW, Washington 6, D.C. Only books published within a year of receipt will be reviewed. Books marked with a ★ are those published by Bulletin advertisers.

Marine Algae of the Eastern Tropical and Subtropical Coasts of the Americas. WILLIAM RANDOLPH TAYLOR. 870 p., illus. The University of Michigan Press, Ann Arbor. $19.50.

The publication of "Marine Algae of the Eastern Tropical and Subtropical Coasts of the Americas" by Professor William Randolph Taylor represents an exceedingly important advance in phycology in particular, and in plant science in general. A product of the University of Michigan Press, supported in part by funds from the National Science Foundation and other sources, the attractive volume with more than 80 full-page illustrations represents a highly significant contribution to our knowledge in a field somewhat neglected at present. The volume is a tribute to Professor Taylor's abundantly demonstrated gifts of synthesis and collation. The literacy of the writing in the preface and extensive introduction are refreshing and stimulating in comparison with much of the stereotyped scientific jargon one reads.

The preface summarizes the genesis of the present volume and the author's acknowledgment of aid from persons and institutions. The introduction begins with an historical survey of earlier phycological studies of the region and then defines the scope of the work both geographically and with respect to method and sources. It includes a succinct account of distribution of the marine algae of the region, illustrated by 14 halftone "text figures," and of methods of collection and preservation. Although the work of many earlier observers is included, the author demonstrates clearly his firsthand knowledge of field conditions.

The body of the book presents a systematic treatment of the taxa in six classes of algae (the Myxophyceae and Bacillariophyceae not being included). There are included keys to the families, genera and species. This section is copiously illustrated at the end of the book with high-quality line drawings and halftones. Distributional notes and taxonomic references are included for taxa at the generic level and below it. Twelve new taxa are described at the end of this section. Twenty-six pages of citations of relevant literature and a carefully prepared index enhance the value of this volume.

The fact that the author has been assembling material for this book for more that 35 years has resulted in an authoritative and comprehensive treatment of the marine algae for the eastern tropical coasts of the Americas. Although in his preface Professor Taylor modestly reminds the reader that his volume is a pioneer work and, by implication, apologizes for omissions of species likely to be encountered, it is clear that the end result of this pioneering effort has been to enrich botanical literature in monumental fashion. *Harold C. Bold, University of Texas.*

Genetic Research. ARNE MÜNTZING. 345 p., illus. LTs Förlag, Stockholm (1961) $7.00.

This book is an English version of the second (1960) edition of a text originally published in Swedish. A German translation of the original was accorded merited praise by geneticists of international reputation, and the present work, thoroughly revised to include the most recent advances in several new fields of genetics, promises to be equally well received by the English-reading public. It is unquestionably one of the most up-to-date texts featuring a comprehensive coverage of the field of genetics, and is ideally suited to the basic genetics course of colleges and universities.

The broad biological implications and practical applications of genetics are clearly presented with the basic principles in a stimulating, easy style not overburdened with terminology. The versatility of the book is enhanced by a careful choice of examples. It is superbly illustrated and provided with convenient sub-headings in a 2-column format which does credit to modern text book design.

Beyond the classical areas of genetics largely covered in the first 19 chapters, a chapter on physiological and biochemical genetics succinctly presents the concept of the genetic bloc and its significance in elucidating the chemistry of life processes. Another deals with transformation, transduction and other phenomena relating to the genetics of bacteria, phages, and other viruses, and reveals the challenge of this expanding field of research. In the chapter on the nature of the gene, the cistron-muton-recon concept is documented largely by evidence from the histidine region in *Salmonella*. The chemical structure of the gene is dealt with in terms of the Watson-Crick models for D N A. The chapters on mutations, species hybrids, polyploidy and plant breeding reflect the author's breadth of research contact and experience. Separate chapters are devoted to heterosis, evolution, animal breeding and human genetics.

Although a list of selected books and periodicals on genetics is appended, teachers especially may wish that pertinent references and study questions were included with each chapter. *B. Lennart Johnson, University of California, Los Angeles.*

Marshall's Physiology of Reproduction: Vol. I, Part II. A. S. PARKES, Ed. Longmans, Green and Co., Inc., New York. (1961).

The appearance of this part of the third edition of the *Physiology of Reproduction* is an indication of how much our knowledge of this field has grown since the first edition in 1910. This volume has the most complete coverage available on the comparative aspects of every phase of formation and development of sperm right up to the point of fertilization by natural or artificial insemination. This section of the book will make it extremely valuable for either the basic researcher in this field or the medical worker interested primarily in problems of human reproduction. The more recent advances in the field of biochemistry are well demonstrated in the section of maturation, metabolism and motility of mammalian sperm. The process of fertilization has intrigued man since the time of the discovery of spermatozoa in 1677. We have come a long way from this period when men of science believed that either the sperm or the ova, but not both, produced the next generation.

The last half of the book is concerned with the reproductive endocrinology of the lower vertebrates and birds and will thus interest a more restricted group of readers. The section on birds is very complete and should serve as essential source material for the avian endocrinologist.

The relationship between environmental factors and sexual periodicity has long interested the reproductive physiologist. Our present knowledge on the exteroceptive influences on breeding in both lower and higher animals is brought together in the last chapter in this book.

This edition will serve as a very fitting memorial for F. H. Marshall and Arthur Walton, both of whom were very active in this field as experimentalists as well as authors. *Ivan M. Lytle, Department of Experimental Biology, University of Utah, Salt Lake City.*

Principles of Animal Taxonomy. GEORGE GAYLORD SIMPSON. 247 p., 30 diagrams. Columbia University Press. (1961) $6.00.

A good many controversial things have been published in the last quarter century on the philosophical aspects of systematics. Undoubtedly the most common source of the differences of opinion has been the terms employed. Many of these are of highly subjective nature; as Gregg put it, they are "among the most equivocal of English expressions."

Dr. Simpson's latest book is chiefly concerned with the concepts and philosophy of classification, and he makes a real effort to avoid the equivocalities by careful definition and employment of terms. So far as imparting an understanding of his views is concerned, the book is unusually successful. Many ambiguities are discussed, and many expressions or concepts are clarified. One major exception to this has been noted.

The book is about principles, supposedly ones applicable to all animals, —the principles of taxonomy. This term is common in book titles and in conversation, but no one ever bothers to state its meaning. Dictionary definitions cover such a wide range that the word is well-nigh useless for communicating anything definite. The book deals with many general concepts and with the philosophical background of taxonomy.

There has been a widespread need for a work on the theoretical basis of classification for use by students and workers who must identify, classify, and record the diversity of organisms. Dr. Simpson's book is not designed for this elementary level, but is rather addressed to the taxonomist who wishes to clarify his own concepts and think about the philosophical aspects of his work. It is thus an advanced taxonomy book, designed more for experienced taxonomists than for beginning students.

The book consists of six chapters: 1) Systematics, Taxonomy, Classification, Nomenclature. 2) The Development of Modern Taxonomy. 3) Taxonomic Evidence and Evolutionary Interpretation. 4) From Taxonomy to Classification. 5) The Species and Lower Categories. 6) Higher Categories.

The theme is emphasized in chapter 3. The evolutionary nature of variation, the phylogenetic basis of classification, and the availability of phylogenetic data are major aspects of this theme. It may seem to some that the phylogenetic assumptions go substantially into the realm of appealing but unproven acceptances. If the assumptions were to be denied, many of the book's conclusions would be unacceptable.

Nevertheless, this is an unusually clear exposition of a subject that is usually choked by semantic difficulties. It is recommended as thought-provoking to all who are interested in the philosophy of taxonomy. *Richard E. Blackwelder, Southern Illinois University.*

The Beetles of the United States (A Manual for Identification). ROSS H. ARNETT. Section 1, Fascicles 1-9, xi + 210 p., illus. The Catholic University of America Press, Washington, D. C. $3.50 (subsequent sections priced according to number of pages), binder $3.95. Completed work $25.00, $28.95 with binder.

Dr. Arnett, in his acknowledgements, points up the need for a simple tabulation of the morphological characters found in each family of beetles to make it possible to identify these insects with the greatest amount of ease. This objective has guided him in the preparation of the manual.

The presentation offers an interesting and most useful departure from the manual's predecessors. The work is arranged in sections, of which approximately eight will be published. The first section, reviewed here, includes an introduction plus nine fascicles treating nine families of beetles.

The introduction, consisting of 45 pages, points out the advantages of the loose-leaf form of the book allowing the user to arrange the parts to suit his needs and permitting him to remove parts for revision. Each fascicle is restricted to a single family of beetles, is separately indexed, and has its own pagination, as well as being paged with the whole. It is thus complete in itself, but the whole manual has continuity. There will be also a general index which will make it possible to refer to entries in any fascicle. Dr. Arnett had in mind three possible arrangements of the fascicles: 1) alphabetically, for ease in finding a particular family, 2) by natural phylogenetic sequence of families according to the classification scheme adopted by the user, or 3) by page number as originally issued.

Further, the introduction has a brief, but informative, description of the external morphology of adult beetles with illustrations pointing out those structures used in identification. Next, there is a key to the families of Coleoptera of the world, followed by a bibliography of general works, a list of abbreviations used in all the keys and illustrations, and an index to the introductory material.

The fascicles generally give a brief description of the family, its general ecology, status of classification, distribution, and notes on the classification. A key to the genera in the United States is followed by a brief discussion of the classification with notes when appropriate. There is a bibliography for each family.

The format of the book is excellent. The binder is of fine quality, sturdy, and attractive. The paper is rather thin and there is some likelihood that the pages will tear easily unless care is used in handling them. A few typographical errors are minor and not detracting.

The appearance of this manual is a milestone in systematics and will lead others to follow this extremely useful method of publication. The book will be very helpful to students of insect taxonomy and will certainly find wide acceptance in this field. Dr. Arnett is to be congratulated for his vision and talents in the preparation of this fundamental work. *Lewis Berner, Department of Biology, University of Florida.*

Introductory Botany. ARTHUR CRONQUIST. 892 p., illus., Harper & Brothers, New York, N.Y. (1961) $9.25.

This book is designed for a two semester course in modern botany with the major emphasis on organisms rather than molecules. The approach is phylogenetic, proceeding from the simple to the complex. A modern scheme of classification employing 16 divisions of the plant kingdom is used. This scheme is compared with the older 4 division scheme, but no mention is made of other schemes in use by many botanists. (i.e. Tippo 1942 and Bold 1957).

The book begins with a somewhat traditional discussion of botany as a science. Structure and function of cells, cell division, and sexual repro-

duction are considered prior to the introduction to taxonomy. Next the divisions of the plant kingdom are each discussed in some detail. A brief discussion of viruses in included, but it is noted that they are of uncertain taxonomic status. Twelve chapters are used to discuss the Division Anthophyta—thus coverage is made of structure and function in roots, stems, leaves, and flowers, as well as of food synthesis, soil and water relations, mineral nutrition, growth and movement, and the economic importance of the group. The last four chapters deal with heredity, evolution, plant communities, and plant geography. Since the evolutionary relationships are indicated for each division, it seems almost anticlimactic to leave the chapter on evolution so near the end of the book. However, the sequence of chapters in the book can be modified in teaching practice.

The author states that he has tried "whenever possible to bring the student to the boundary of our knowledge, and to peer into the future." Specific examples of this attempt include consideration of recent additions to our knowledge of cell structure learned from electron microscope studies and DNA and RNA research; the use of a modern classification system and emphasis on evolutionary relationships; and a brief but modern treatment of plant anatomy when applicable.

Plant physiologists and geneticists may feel that their fields have been treated too briefly, however, in general the book gives a comprehensive treatment of introductory botany. *Addison E. Lee, The University of Texas.*

Flora of the Santa Cruz Mountains of California, A Manual of the Vascular Plants. JOHN HUNTER THOMAS. 434 p.; illus. Stanford University Press. Stanford, California. (1961) $8.50.

From this midwestern vantage-point, one is made to wonder about the value of another manual of California plants. On the other hand, botanists of the San Francisco area are undoubtedly welcoming Thomas' Santa Cruz Flora with open arms, because here is a well-prepared, concise manual which should serve admirably for teaching purposes and as a guide for the numerous local naturalists.

This book contains all the information one would hope to find in a local flora . . . accounts of the geography and geology of the area (by Earl E. Brabb), notes on the climate, a brief discussion of the plant communities with lists of the most important species, pertinent reference material, a glossary, indices to place names, common plant names, and scientific plant names, a most interesting historical account of botanical collecting in the Santa Cruz Mountains, and most important, well-prepared keys and notes pertaining to each of the approximately 1800 taxa covered. The illustrative material, which is taken from Abrams' *Flora*, is of exceptional quality. It is unfortunate that additional illustrations could not have been included, and that they could not have been made a bit easier to associate with the text material. The usefulness of the book as a field manual would have been enhanced if a lighter weight paper had been selected, but it is not impossibly heavy.

The book is remarkably free from errors, reflecting painstaking attention to details by both author and publisher, who are to be congratulated for a job well done. *Dale M. Smith, University of Illinois.*

★Advances in Morphogenesis. Vol. 1. M. ABERCROMBIE, and JEAN BRACHET, Eds. xiii + 445 p. illus. Academic Press Inc., 11 Fifth Avenue, New York, and London. (1961) $12.50.

With this first volume of *Advances in Morphogenesis* a new and rapidly expanding field of biological endeavor has entered the "annual review" field. But, to be sure, *Advances in Morphogenesis* is not strictly a review of the past year's research in a chosen field. Rather, it consists of a series of chapters, nine in this first volume, written by specialists on the subjects of and about their own research. The editors feel that it is "no longer possible to review completely everything that has been published on a biological topic . . ." and that "the common solution to the problem is to build some or all of a review frankly around the author's own work. . . ." This thesis forms the basis for each of the chapters, but it should be emphasized that authors have incorporated much background information and supporting data from the papers of their co-workers.

Chapters in the volume under discussion deal with the organizer in embryos, the embryology of ascidians, regeneration of vertebrate appendages, action of morphostatic substances and proteases in regenerating tissues and tumor cells, determining factors in cell growth and morphogenetic implications in plants, differentiation of vertebrate pigment cells, limb morphogenesis, morphogenesis in the vertebrate eye, and certain aspects of development in the teleost egg. Each chapter begins with a brief introduction and terminates with a list of references. At least one chapter has a further supplementary list of the most recent references added. At the end of the volume, useful author and subject indices are appended.

Although morphogenesis is a phenomenon common to and equally manifest in all organisms, this volume lays stress on morphogenesis in animals, and eight of the nine chapters deal with zoological subjects. The editors state that "one-sided chapters can always be balanced by subsequent reviews in the same field." Let us hope that the subject material of one-sided volumes will receive the same consideration in future editions. In all, *Advances in Morphogenesis* is a well prepared volume, authored by competent scientists, and it answers a need in a field which has come to the forefront of biological research in recent years. *William L. Stern, Division of Woods, Smithsonian Institution.*

Attention All Prospective Employers of Biologists and Agriculturalists . . .

- The NOVEMBER 1961 PLACEMENT DIRECTORY is currently available. Resumés of approximately 135 biologists, their professional qualifications, training, and experience appear in the November Placement publication. Cost per copy is $2.00. The February 1962 Placement Service Directory will be available for distribution on or about February 5, 1962. Employers who wish to have their current or prospective opening included in the Placement Service Lists of Job Opportunities, may do so by directing their requests to the AIBS Placement Service Office.

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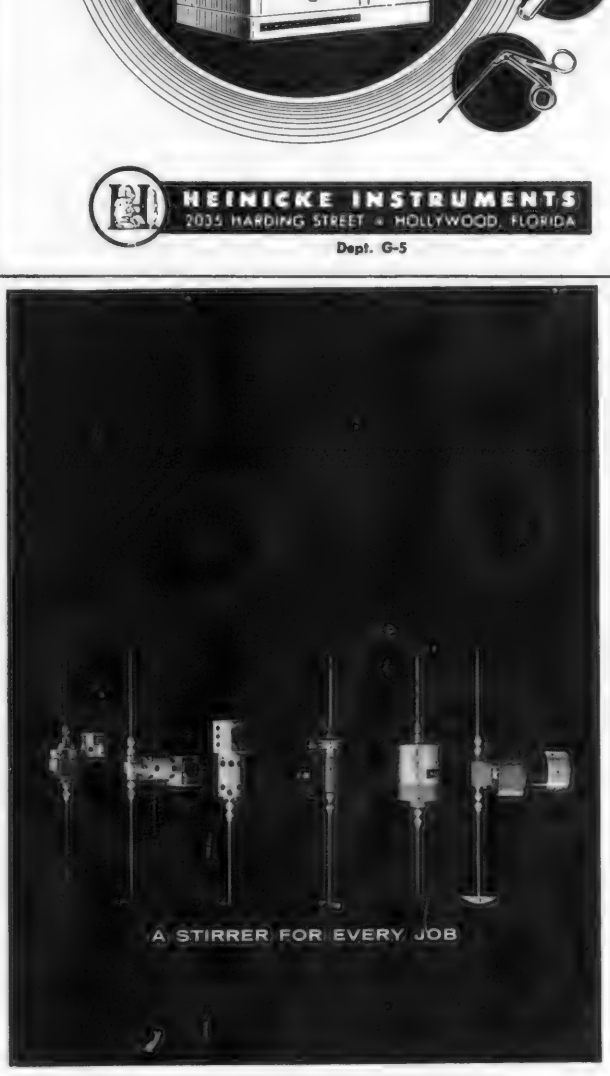

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MH COLLEGE DIVISION

METHODS AND MATERIALS FOR TEACHING THE BIOLOGICAL SCIENCES
Second Edition

By DAVID F. MILLER and GLENN W. BLAYDES, The Ohio State University. Available January, 1962.

This text is designed for use in college courses training prospective teachers of the biological sciences in junior high school, high school and junior college, and for teachers in training. The first part of the book is designed for classes in special methods; the second part contains suggestions for demonstrations and experiments.

STEREOCHEMISTRY OF ORGANIC COMPOUNDS

By ERNEST L. ELIEL, University of Notre Dame. *McGraw-Hill Advanced Chemistry Series.* Available February, 1962.

Using a sound theoretical approach based on the thermo-dynamic and kinetic concepts wherever possible, this advanced and updated book develops the essential concepts of stereochemistry. Of interest to organic chemists, biochemists and physical chemists.

PRINCIPLES OF NEMATOLOGY

By GERALD THORNE, University of Wisconsin. *McGraw-Hill Publications in the Agricultural Sciences.* 553 pages, $15.00

Prepared by a world authority, this book opens with a brief historical account of the achievements of early workers in nematology. The importance of nematodes in agricultural economy is stressed and examples cited of the crop losses incurred. Techniques used in field and laboratory work are discussed and special equipment described. Emphasis is placed on the importance of detailed morphological studies in the identification of species.

ELEMENTS OF ZOOLOGY, Second Edition

By TRACY I. STORER, University of California, Davis; and ROBERT L. USINGER, University of California, Berkeley. *McGraw-Hill Publications in the Zoological Sciences.* 480 pages, $7.25

This edition of the abbreviated version of GENERAL ZOOLOGY includes new developments in physiology and bio-chemistry; discusses the role of DNA and RNA in cell functions and chromosome duplication; emphasizes the central place of enzymes in biological systems; updates material on ecology and includes important new animal types —the Pogonophora and Neopilina.

THE MOLECULAR CONTROL OF CELLULAR ACTIVITY

Edited by JOHN M. ALLEN, University of Michigan. Available January, 1962.

This symposium volume, containing articles by a number of outstanding biologists, aims to re-synthesize some of the fragmented material in the field of cellular biology. The objective has been to take a very broad and general view of recent advances in understanding of the molecular organization of cells and the ways in which molecules themselves interact to control the function of the cell.

PLANT MORPHOGENESIS

By EDMUND W. SINNOTT, Yale University. *McGraw-Hill Publications in the Botanical Sciences.* 550 pages, $12.50

Written by a distinguished scientist and the senior author of BOTANY AND PRINCIPLES OF GENETICS, this book shows the growth of plant morphogenesis from a relatively minor aspect of botanical science to a much wider recognition as one of the central concerns of biology.

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ZOOLOGY, Second Edition

Alfred M. Elliott, *University of Michigan*

This best-seller has sold over 100,000 copies. The unifying theme of the text is the concept of organic evolution. Briefly, the author describes how animals come into being, how they transmit their characteristics to their offspring, and how their body structures and functions enable them to exist. The emphasis is on principles, with a minimizing of taxonomic details. Results of recent research on a range of subjects extending from the circulation of blood in amphibians to the effects of radiation on genes are incorporated in this edition.

746 pages, illustrated, $7.00

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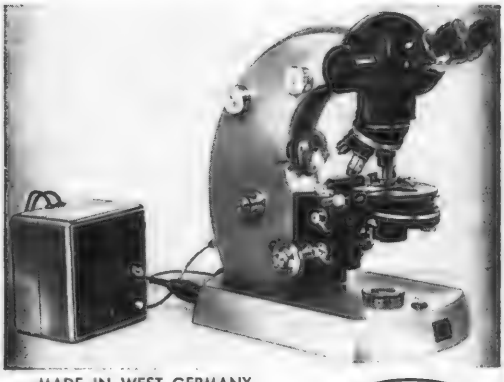

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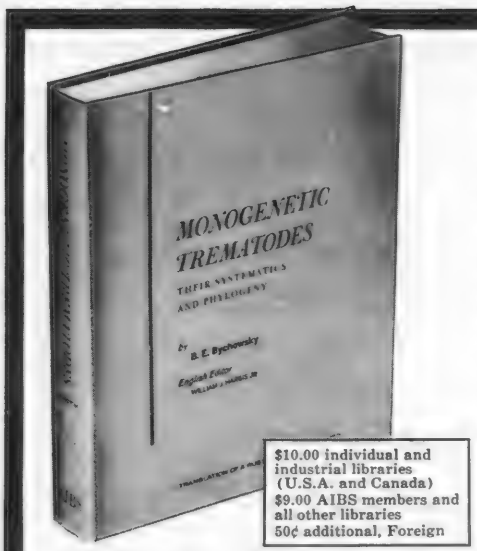

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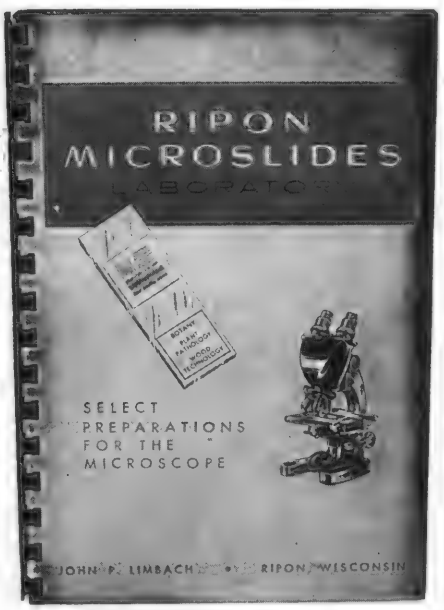

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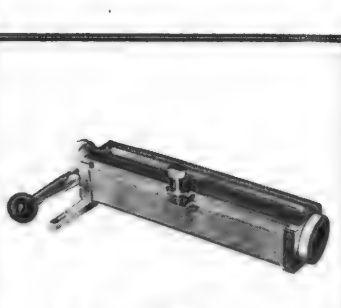

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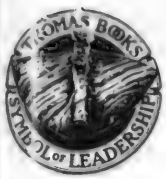

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INDEX TO ADVERTISERS

Academic Press .....Cover 3
AIBS 12, 40, 42
American Phytopathological Society 44
American Tobacco Co.....Cover 4
Appleton-Century-Crofts, Inc. ..38
Biological Abstracts 46
Brinkman Instruments, Inc. 44
Burgess Publishing Co. 43
Da Vinci (Doolittle) 47
Eberbach Corp. 36
Chas. J. Lane Corp. 7
E. Leitz, Inc. 11
W. H. Freeman & Co. 41
Graf-Apsco Co. 8
Harvard University Press 44
Heinicke Instrument 36
Macmillan Co. 10
McGraw-Hill Book Co., Inc.....37
Mistaire Labs 47
C. V. Mosby Co. 9
Nuclear-Chicago Corp. 14, 15
Pergamon Press, Inc. 39
Phase Films 47
Prentice-Hall, Inc. 6
Reinhold Publishing Corp. 13
Ripon Microslides Laboratory....42
Ronald Press Co. 4
Row-Peterson 47
W. B. Saunders Co. 1
Science Associates 47
Charles C. Thomas 45
Triarch 43
Unitron .....Cover 2
D. Van Nostrand Co., Inc. 16
Carl Zeiss, Inc. 38

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By FRANÇOIS JACOB *and* ELIE L. WOLLMAN, *Institut Pasteur, Paris*

September 1961, 374 pp., $10.00

In the establishment and development of bacterial genetics, sexual phenomena in bacteria have provided a primary tool. In this monograph two major contributors to progress in this field give a detailed account of sexual processes in bacteria. They also describe some of the main advances in the understanding of bacterial physiology and genetics made by the study of bacterial conjugation. For example, they analyze the genetic determinism of lysogeny, by which process a virus may become an integrated part of the host chromosome in bacteria.

PLEUROPNEUMONIA-LIKE ORGANISMS (PPLO)—MYCOPLASMATACEAE

By E. KLIENEBERGER-NOBEL, *Lister Institute of Preventive Medicine, London*
with a contribution by S. RAZIN, *Hadassah Medical School, The Hebrew University, Jerusalem*

January 1962, 157 pp., $6.00

Recent developments indicate that mycoplasmataceae play an important role in diseases afflicting man as well as domestic animals, particularly those of the respiratory and genito-urinary tract. Dr. Klieneberger-Nobel, who has devoted more than thirty years of research to these organisms, has written definitively and authoritatively on the morphology, cultivation, pathogenicity, immunology, and therapeutic susceptibility of pleuropneumonia-like organisms. Nutrition and metabolism are covered in a chapter contributed by S. Razin.

MEIOSIS and MITOSIS

By M. M. RHOADES, *Indiana University, and*
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September 1961, 440 pp., $12.00

Meiosis (pp. 1-75) *By* M. M. RHOADES
Mitosis and the Physiology of Cell Division (pp. 77-412) *by* DANIEL MAZIA
AUTHOR INDEX—SUBJECT INDEX (pp. 413-440).

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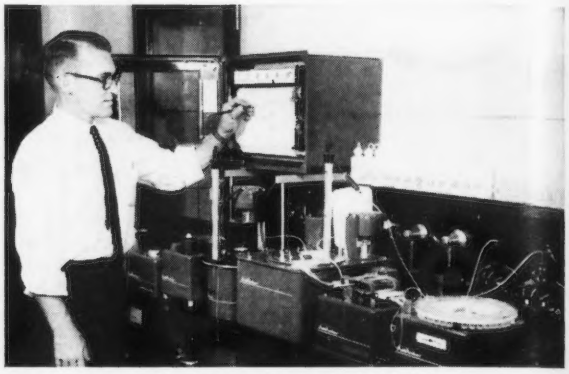

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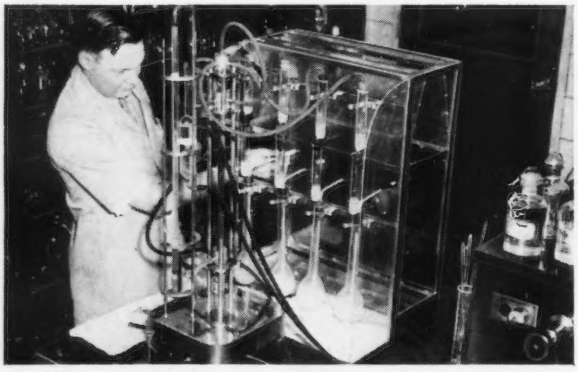

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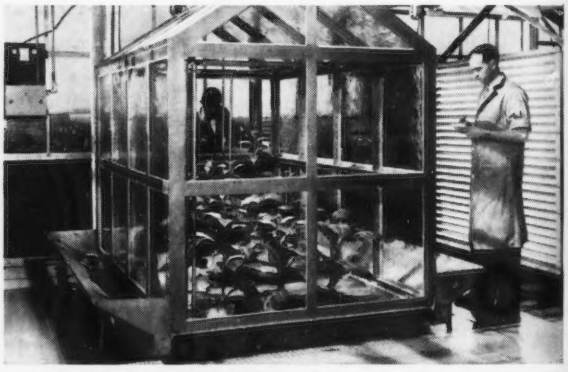

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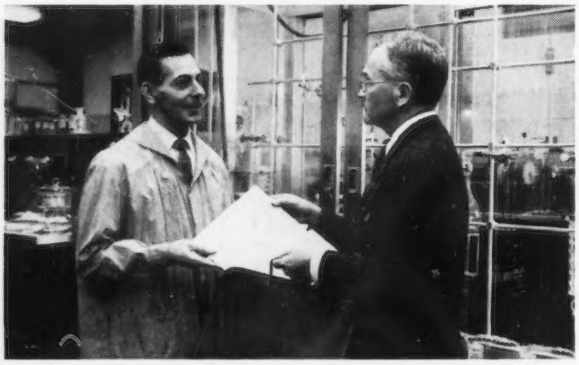

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